AMERICAN MACHINIST

A JOURNAL FOR MACHINISTS, ENGINEERS, FOUNDERS, BOILER MAKERS, PATTERN MAKERS AND BLACKSMITHS.

VOL. 15, NO. 48. WEEKLY. | NEW YORK, THURSDAY, DECEMBER 1, 1892. | $3.00 per Annum. SINGLE COPIES 6 CENTS.

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Improved Universal Wood Worker.

We present with this an illustration of a new universal wood-working machine, in the design of which the aim has been to produce the most complete and comprehensive machine of its class possible to build.

The machine is substantially proportioned, the frame being cast in a single piece, and ample bearings provided for all moving parts, while at the same time special attention has been given to making adjustments as convenient as possible. In the hands of a competent operator its range in variety of work is very extensive, and it will plane out of wind, make a perfect glue joint, square up all kinds of stock, do chamfering, cross-gaining, plowing, work tongue and groove, cut straight, circular or elliptical moldings, raise any style of panels, rabbet door frames, rabbet and joint window blinds at the same time, do ripping, cross-cutting, tenoning, and numerous other operations, all of these being well done.

The frame is cast in one heavy cored-out piece with well-spreading base, giving good steady floor support for the machine.

The tables are extra long and wide, and give sufficient surface for the material when planing out of wind, making glue joints, etc. The variety and convenience of adjustment of these tables is a leading feature of this machine, and either table can be adjusted separately or both together with the circle of the head to regulate the depth of the cut, as in planing out of wind, cornering, jointing, etc. Both tables can also be raised or lowered in a vertical line, keeping them on the same level, and retaining the same distance apart. This is especially advantageous when changing the depth of the cut in gaining, plowing, raising panels, rabbeting, ripping and cross-cutting and other work. All of these adjustments are regulated by the large hand-wheel shown in front of the machine, and can be attended to without the operator changing his position.

The table tops have also plain guide ways for receiving a sliding frame, that is used for gaining, cross cutting, etc.; by placing a piece of wood in these planed ways and inserting the saw board between the tables, a bridge is formed over the gap, making it a continuous saw table.

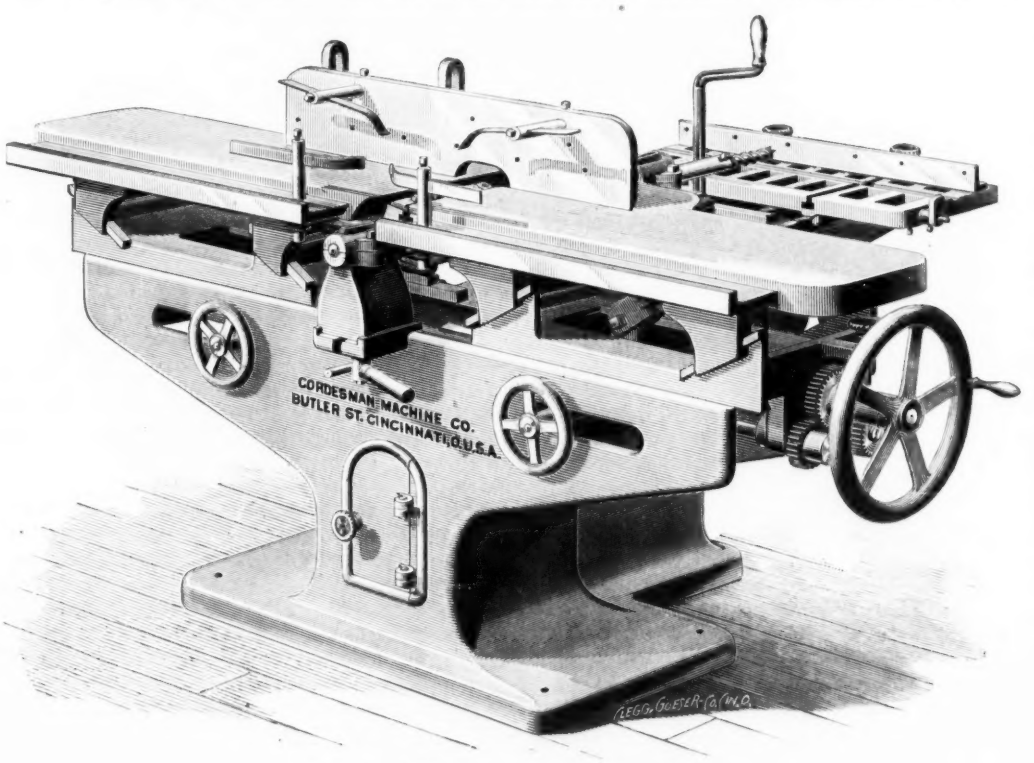
The tables can also, without disturbing their relative height, be drawn clear back from head, for the purpose of substituting various heads and bits. To do this it is only necessary to unlock the hand-wheels shown in front of the machine.

The mandrel is of steel, with ground bearings which run in three self-oiling babbitted boxes, the driving pulley being between two of these, which are 6" long, the outside bearing being 5" long and made detachable, for convenience in changing the heads, saws, etc.

All three boxes are carefully fitted to the main frame; the two back boxes are provided with gibs, and with the mandrel can be moved back and forward across the machine to suit any slight change in the position of the cut without interfering with the fence. This is accomplished with a screw actuated by a detachable crank handle, shown in front of the machine.

The boring apparatus is very simply constructed and has all requisities of an independent horizontal borer. The tables can be raised and lowered and moved back and forward with the greatest ease. It is supplied with an adjustable fence for angle boring; also necessary stop and gauges for spacing the work.

The fence is made of iron, with sufficient strength to prevent springing, and has a free adjustment across the full width of the table. It can be swung on an angle to get a diagonal cut, and can be adjusted from a vertical plane to an angle of 45 degrees Being mounted on the rear table, the depth of the cut can be regulated by the front table without interfering with its position. Presser springs are provided on both fence and tables to hold down the work.



IMPROVED UNIVERSAL WOOD WORKER.

The machine is furnished complete with countershaft for ordinary work, with the following attachments: One 10 inch slotted steel head, one rabbeting head, one jointing head, panel and rabbeting iron, saw board, saw collars and flanges, and necessary wrenches. Other special frames and fences, such as are used for rabbeting, gaining, etc., and any style of head will be furnished.

In some instances the machine is equipped with an additional head, for working beading, jointing, etc., performing two operations on the same piece at the same time. The machine is made by the Cordesman Machine Company, Cincinnati, Ohio.

The manufacture of steam pumps has come to be one of the great industries of this country. Steam pumps of American manufacture or American design undoubtedly lead the world.

Technical Education: Its Use and Abuse.*

In a technical *school* we must for the most part confine our teaching to the hard facts and to the scientific developments, and leave the intuitive faculty to grow by help of its own innate vigor, but even with regard to this latter there is no reason whatever why the general influences of the school should not favor this growth, and a boy who has, for instance, practiced in the drawing office of a well-managed technical school for a couple of years will prove himself a very great "duffer" indeed, if in that time he has not greatly advanced in his intuitive perception of good or bad proportioning of the details of machinery. To take another example, a boy who has worked for a considerable time in the smithy of a technical school will show that he possesses no practical talent if he leaves it without having gained in some useful, although still limited degree, the intuitive faculty of judging the lengths of time needed to keep in the fire bars of different sizes and shapes for the purpose of subjecting them to one or other forging operation. Even then, with regard to this most difficult and tedious part of technical training—namely, the growth of reliable instinctive faculties, I claim that the technical school can at least make a good beginning, and that such an appreciably useful beginning is actually made in all technical schools that do their work properly.

Regarding the other parts of the work, we have more definite gauges whereby to measure the usefulness of the school; there are more definite things to be done. Regarding the details of industrial processes there exists among manufacturers and engineers a very general skepticism as to the power of the school to produce any real practical results; and the majority of general educationists is, I fear, inclined to agree with them. It is said, "Oh, no; you can't do anything that way in the school; such things can only be learned in the practical business workshop." I maintain that this is an entire mistake. Supply the school with the proper material and personal equipment, and allow the scholar sufficient time, and you will find that these details *can* be learned in the sense that the scholar can obtain a familiar mastery of them. What a mere school training can *not* do is to impart that habitual caution and careful accuracy which comes only from a sense of responsibility. The scholar pays his fee and thinks he does his whole duty if he submissively accepts the lesson for which he has paid the fee; he cares little whether he makes a blunder in executing the exercise that is given him, knowing that the evil results of his blunder are for the most part confined to himself, and that there are no ulterior consequences of any very grave or dreadful sort—none such as would in the other place cause the foreman suddenly to blaze forth in language quite unfit to be heard within the sacred precincts of the college. Practically the worst that he can fear as the result of his error is the waste of so much material, and he has rather a habit of thinking that because he has paid a fee he has the right to waste so much material per day, the proper amount being settled by himself within his own private conscience. This can be only very partially rectified by providing the students with none but what I may call *real* work, that is to be actually utilized in the making of some machine or other important product. If he is shown an important, useful aim in view, in which others besides himself have a substantial interest, he is made to feel ashamed if its attainment is hindered or made more laborious and expensive, or altogether frustrated, by his fault; but it is only in a very mild and limited degree that you can carry out this discipline in the school or college. Its influence can only be felt to the full needful extent in the actual business workshop.

But in the use of all kinds of hand and machine tools, measuring instruments, and all kinds of apparatus used in chemical or other industrial processes of manufacture or in testing, whether the test be of a chemical or of a physical nature, the student can be trained in the school as well as, or rather, I should say, much better than in the works, always, however, under certain conditions and certain limitations, which I will immediately define in detail. Note the difference between the two modes of learning. The unfortunate works apprentice is pitchforked into some special part of the works and practically cast adrift there. The foreman from time to time, in passing, in hurried moments, takes sidelong squints at him, meditates on him for the instant as the last newly imported nuisance, and makes a daring mental calculation of how long it may be safe to leave him alone in his misery with nothing to do, and how much longer it may be safe to employ him solely in doing scavengers' and laborers' work or that of the infantile message boy;

*Conclusion of Inaugural Address delivered by Professor R. H. Smith at the opening meeting of the Mason College Engineering Society, at Birmingham.

for as long as is humanly possible the policy is followed of giving him no work of such degree of instructive difficulty that there exists the faintest risk of his spoiling sixpence-worth of material. It is nobody's business to help him in any way or teach him anything, and if he is taught anything he is made to feel that at each step somebody else is sacrificing time and trouble to help him, as he has no right to be helped. In fact, instead of being helped along, almost every conceivable obstacle seems to be placed in the way of his progress, and it is only after a long period of weary waiting and trial that any really fair opportunities are afforded him of learning by dint of his own exertions. Many generations ago, before the days of large manufactories, and under the old system of close personal relations between master and apprentice, no doubt the young man got fairer play, and no doubt in many works of the present day an honest effort is made to do as much justice to the apprentice as the system will permit, but the whole organization and method of modern production is dead against the apprentice, and defeats even the best intentions and the most honest good will on the part of proprietors of the works. Thus, although the picture I have drawn will not fairly apply to some works, it can hardly be said to be an exaggeration if it is taken to aim at the average.

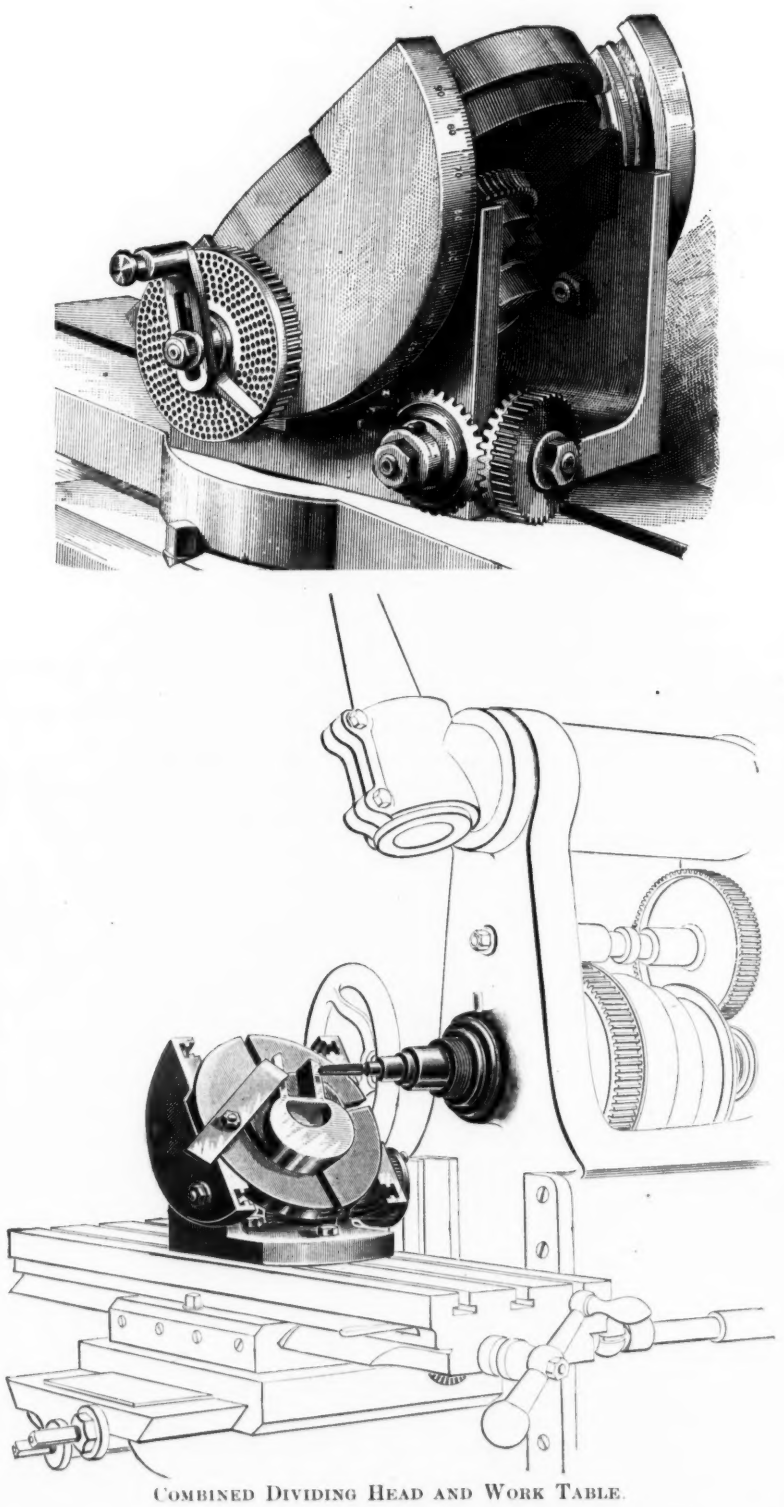
On the other hand, in the technical school everything that can be done is done to help the pupil to learn. There are those at hand whose sole duty it is to show him the best way to perform each particular operation; who watch his progress and correct his errors; who are especially selected because of ability to be patient in face of continuous blundering, and because of their special power to encourage the pupil and inspire confidence at times of particular disheartenment. All those conditions dependent on the main aim of the institution are the exact converse of those of the works; there the rapid and economical production of finished work is the sole object in view, and the good of the apprentice is supremely unimportant. Here the good of the pupil is everything, and the rate of production and its economy are entirely subordinated to his advantage.

And now as to the conditions and limitations under which the technical school can thoroughly perform its function of helping students to make themselves familiar with and skillful in the detailed uses of the tools, apparatus and methods of industry.

In the first place, the school practice and teaching must be given due *time*, to have its proper effect. If you take a lad who has been working laboriously all day at some other kind of work, and expect to convert him into a skillful machinist by setting him once a week for an hour in the evening to practice lathe turning, all I can say is that you will need to wait a very long time indeed before discovering any perceptible advance towards the desired result. If you invite an office clerk to spend a couple of his evening hours once a fortnight in a chemical laboratory, and lead him to hope that this process will fit him to be a public analyst or the assistant of a public analyst, you will deceive him most egregiously. Time has to be devoted liberally to the acquirement of technical skill and knowledge. An adult of fairly vigorous health and intelligence may be able, for all that I know, to acquire a complete familiarity with all the rules of Latin grammar in half a dozen or a dozen hours, but he cannot learn the niceties, and the ways over the stumbling-blocks of lathe turning, in ten or twenty times that period. The process is to be properly compared to acquiring the familiar and easy use, in speech and writing, of the Latin tongue, and that, we all know, takes considerably longer than the learning of the Latin grammar.

Secondly, the men chosen to teach the students of a technical school must themselves know what they are supposed to teach, and, moreover, must understand it in an intelligent manner. It is not the right thing to select a skillful carpenter to be chief workshop instructor, and to expect him to teach plumbing, metal turning, planing, chipping, filing, forging and iron founding, besides the preparation of varnishes, oil paints and chemical dyes. If he be enterprising, and has read several text-books on these various subjects, he *may* undertake to do it, and he may even be bold enough to promise you to teach as well in spare moments the arts of watch making and of making drawings of marine and locomotive engines, but his undertakings and his promises will not be fulfilled. You ought to have a number of particularly well-trained specialists, corresponding with the number of special departments of industry you undertake to teach in your school. And in selecting these men you must remember that, however good a technical school may be, it cannot give a complete technical training, so that you must not place as teachers in the school young men who themselves have been trained in the school alone; they must have had the additional training of years of experience in the works, and, moreover, scientific intelligence being a requisite in a teacher, they must also have received a sound general education.

Thirdly, the school requires a proper material equipment. Here it is that we meet the unavoidable limitations of technical school teaching. The possible extent of the technical school teaching is, in some important respects, in proportion to the amount of material that can be supplied to the students to deal with—and material of whatever sort costs money in proportion to its quantity—and in proportion to the extent and the magnitude of the apparatus that can be afforded. Operations carried out on a large scale are in many respects essentially different from those performed on a small scale. In the chemical laboratory you cannot *fairly* illustrate the manufacture of beer. In the metallurgical laboratory you cannot illustrate the production of steel in the Bessemer converter or in the Siemens-Martin open hearth. In a school iron foundry you can gain no sort of conception of the difficulties of building large molds or of making large castings. A small steel ingot is an altogether different physical thing, both inside and out, from a large steel ingot. Smithing small bars of iron is quite a different process to that of forging a heavy crankshaft. Turning in a 6-inch or 9-inch lathe is a different art from that of manipulating one of the big modern lathes whose tools are steel bars 4 inches square. The behavior of steam in a large engine is very different from its behavior in a small one.



COMBINED DIVIDING HEAD AND WORK TABLE.

Now it is impossible to furnish any technical school with the large-sized apparatus of modern industry. I predict the day when twenty times as much money as is now devoted to them will be spent in equipping these schools, but they will never develop so far as to possess this heavy apparatus. They must always remain content with a relatively modest material equipment. But so far as this equipment extends I maintain that the details of industrial processes can be more rapidly, more surely, more economically, and more scientifically learned in a properly managed technical school than in the works. The needful mental and sentient and physical faculties can be more systematically and more thoroughly trained, and to a truer and higher pitch of efficiency and excellence. The needful knowledge can be imparted in more logical and intelligible sequence, and a firmer grip of it in its entirety can be acquired. The path of the learner can be kept clear of local prejudices and ignorances, the results of narrow local experience. Care will be taken that whatever is scientifically intelligible will be explained scientifically and referred to the correct scientific category. The remainder will be left to the digestion of a scientifically trained intelligence, and the chances are that, in the course of years, light upon many as yet unsolved industrial problems will suddenly flash out from these brains developed in the technical school.

It is right also to mention that the necessarily limited material means of the school can in an important degree be supplemented by class visits to outside works, provided that these visits are real working excursions and that the students are induced to observe accurately what they see, and to record the same accurately in their note-books.

In conclusion, let me repeat that no technical school can do satisfactory work without suitable material equipment. But let the equipment be ever so complete, the good or bad result will still depend on the teachers, and the worst of all possible economies in the management of such a school is to employ an insufficient staff of specially trained teachers, and to select as teachers men of superficial knowledge, of unscientific and illiberal education, of narrow, prejudiced habit of mind, or of impatient and morose temperament.

Combined Dividing Head and Work Table.

We present herewith illustrations of a combined work table, angle table and dividing head for use as an attachment on milling machines, planers, shapers, drill presses or any shop tool where work is required to be presented to a cutting tool for operation at any angle.

The construction consists of a base having two quarter circle standards, with "T" stems, on which swings a cradle of a half circle with "T" grooves; this in turn holds a circular table of 10″ diameter. The face of this circular table lies above all the surrounding parts, thus accommodating work of any size, and has cross "T" slots for strap bolts. It also has a large central stem passing through the cradle, upon which the worm-wheel of the dividing head mechanism is keyed. This stem is bored out to No. 5 Morse taper, to take the dividing head center. As the cradle, holding the circular table, swings in a circle, the circular face and the semi-circular sides have always a common center on the face of the table, which never changes its position, giving all work placed on it a constant point for division by the indexes, or measurable adjustment by the graduated check at whatever angle or position the face is set. This point on the face of the table is only 5½″ above the base at whatever angle set, and when clamped fast by the screws, as seen on the inside of the frame, the tool must be very stiff.

The base having a central pivot upon which the tool can turn centrally, and the cradle holding the work table swinging and fastening anywhere from the horizontal to the perpendicular, it is evident that work can be presented to a cutting tool at any possible position or angle.

When used as a dividing head the tool is furnished with a set of index plates with a very large range of divisions, and has the spiral attachment also, as seen in the cut. An entirely new feature of the dividing head mechanism is the patented device for taking up the wear between the worm and worm wheel. This is done by a divided Hindley worm so arranged that the worm-wheel is in constant contact with the threads of the worm its entire length, greatly reducing wear; and the take-up, which can be made in a moment, keeps the bearing contact always the same. This head is made by the States Machine Co., of Hartford, Conn., and we show cut of it as attached to their boring and milling machine.

Cushman Valve Chuck.

This is a special two-jaw chuck made for holding work where it is desirable to operate on the piece at different points without taking it from the chuck. The main jaws are worked in the usual manner by a right and left-hand screw, and on each of these jaws is a rotating disk. On the back side of one disk is cut an index, and the pin engaging in the same is released by the thumb-piece, as shown in cut. The work is held by these disks, and when finished at one point the index pin is withdrawn, and the disks with the piece is revolved until in position for another operation. The disks are shaped to hold the work, and the index is cut to bring the work in the different positions as required, which insures uniformity.

The rotating disks are made in several styles, as shown. Those in the cut are the plain style cut out to hold the tee, and the extra pair at the side of the chuck cut out to hold the elbow. The disks are also furnished with a dovetailed groove, into which can be inserted soft slip jaws, as in regular slip jaw chucks. A special pair of disks are also furnished, adapted for globe valves. Though originally designed for valves, the chucks are now being used for a great variety of work, such as faucets, pipe fittings, bicycle parts, etc. They are made in various sizes, up to and including 18-inch, which is of sufficient capacity to hold a 3-inch globe valve.

The manufacturers are the Cushman Chuck Co , Hartford, Conn.

CUSHMAN VALVE CHUCK.

Planing and Matching Machine.

We present with this an illustration of a new planer and matcher which has been built by the Buffalo Wood-working Machine Co., of Buffalo, N. Y. In designing this machine special attention has been given to strengthening the parts which give most trouble from breakages, and to so arrange that there shall be no delays from these or on account of belts being too loose or too tight, facilities being provided by which the latter can be instantly tightened or loosened in accordance with the work.

The upper cylinder bearings are 2½ inches in diameter, 9 inches long; under cylinder, 2¼ inches in diameter, 9 inches long; matcher spindles, 2 inches in diameter. F. H. Crafts' patent journal box is used to carry these bearings, and the arrangement is such as to give exceptional immunity from heating and injurious wear.

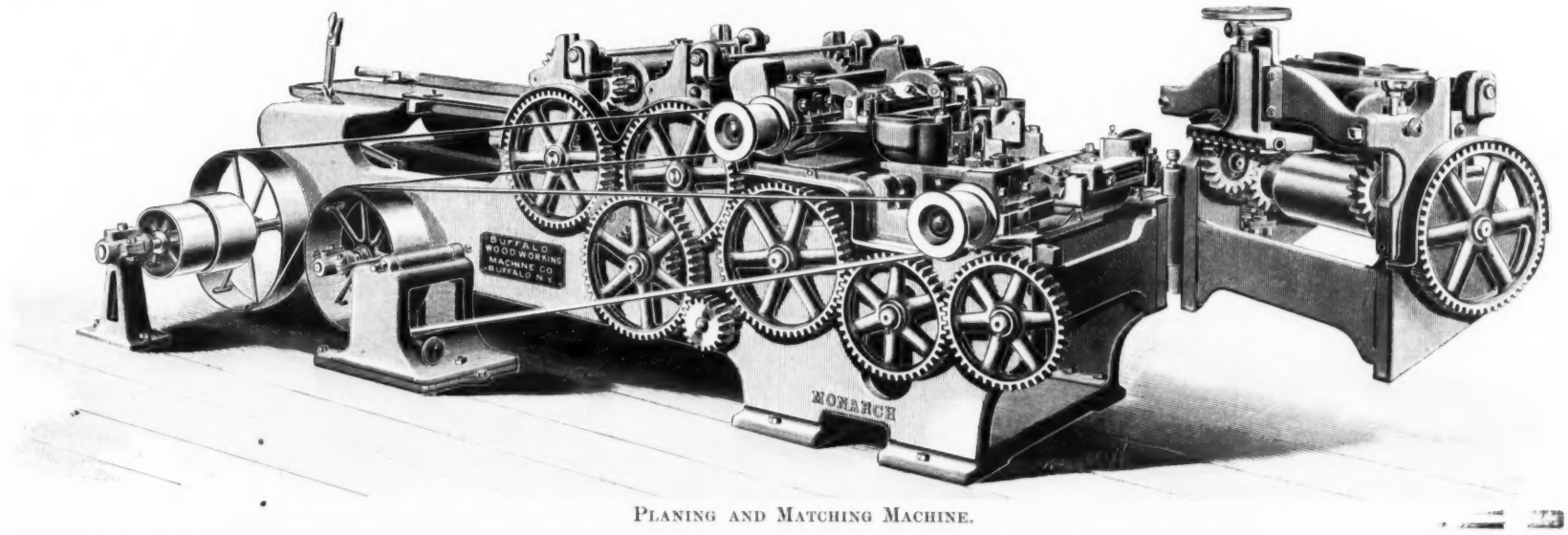
The cylinders are made from crucible steel forgings, and are slotted on four sides. The pulleys on cylinders have a taper fit, and are forced in place under powerful pressure. There are six feed rolls 8 inches in diameter, all double-geared, and they will maintain a parallel position under all conditions. The shafts in the rolls are of steel, 1¾ inches in diameter. Both matcher spindles and the guide bar can be moved simultaneously across the whole width of machine, or matcher spindles can be moved independent of each other, which provides for uniform wear of the bed-plates, pressure bar and chip breaker. The frame is divided, to make the under cylinder more accessible, and this is regarded by practical men as an important improvement.

There are tighteners on the matcher and cylinder belts. The belts are made endless, and all slack is taken up with the tighteners, and the belts will run for years without being cut.

In case a thick board enters the machine, for instance, instead of slacking up on the feed belt, the tightener on the cylinder belt is pulled up, which keeps the cylinder up to speed until the board passes through, when the belt can be relieved of the extra strain, and goes on as before. Again, in changing from thin stuff to thick, instead of having to cut and thus tighten belts which are found to be too loose, it is only necessary to move a lever, which gives the desired tension for the job, which tension can be released when returning to thin lumber, so that just sufficient belt tension, and consequently just sufficient pressure on the bearings to do the work, are all that are ever needed.

The pressure plate over under cylinder is made hollow. Diagonal holes are drilled in to meet this. Rubber hose connects with a fan. When the machine is in motion the hollow space is filled with air, which escapes through the diagonal holes, blowing all chips and dust from the lumber, leaving it clean and bright. This machine is also provided with F. H. Crafts' patent chip breaker, patent pressure bar, patent loose pulley, and other new features for which patents are pending.

If desired, the machine can be arranged to make two matched boards out of one strip, thus doubling its capacity. Countershaft has tight and loose pulleys 14 inches in diameter, 8½-inch face, and should make 950 revolutions per minute. The pulleys on cylinders are 5 inches in diameter, driving pulleys on countershaft 24 inches in diameter, making the cylinders turn 4,560. The cylinders can be run up to 5,000 with safety, if desired. Shipping weight, about 8,000 pounds. Can be built any width desired.



PLANING AND MATCHING MACHINE.

Proceedings A. S. M. E.

TO WHAT EXTENT CAN THE MILLING MACHINE REPLACE THE PLANER ? *

BY W. S. ROGERS.

In the present day, when old machinery has served its allotted time of usefulness in the shop, and must be replaced with tools replete with most modern ideas, it is a matter of no small moment to every practical, progressive shop director having the responsibilities of the annual dividends thrust upon his shoulders, to determine just what type of machines to select that will be best adapted to his especial line of work.

For example, suppose the work has always been done on planers, and they are peculiarly adapted to it, would it be advisable to replace the old with new ones, having latest improvements and added strength ? If so, what will be the percentage of gain in time over those now in use ? Or shall a milling machine be the tool to be placed on trial to shorten the present hours of work performance ? And also what type ? not whose make. In all the written data relating to milling machines and their many good qualities, the writer has been unable to find anything that would enlighten him in such manner that he could know intelligently to a certainty which type of machine would be the most desirable for the class of work to be operated upon, and while investigating preparatory to purchasing, in answer to the all-important question, How much work will this milling machine perform in a given length of time, and how will that amount compare with the work from the planer in the same interval ? the builders of these machine tools give nothing definite whereon we may base our calculations, but confine themselves generally to the superiority of their manufacture over competitors—facts we always concede.

In the particular instance in question, one manufacturer of both planers and milling machines, of extended experience, and who knew from personal observation just what the class of work was, expressed himself favorable to the planer as being the machine best adapted for it.

However, the final decision being adverse to the planer, and the type of milling machine known as the "slabber" being chosen, it was bought and placed in position on solid foundation—especial warning having been given its makers that it would be subjected to the severest duties in its battle for supremacy over its rival, the planer, and a substantial record of its merits over the latter made, if possible. I would like to add right here, in parenthesis, that I have always thought they were just a trifle more slack about it than they probably would have been had they not received our "warnings."

The planer considered in opposition to the milling machine in this test is of modern build (being about three years old), carries two heads, is thirty by thirty inches in the square, with table eight feet long, and has a cutting travel of twenty-seven feet per minute. The tools used are of Mushet's steel, one and one-half inches sectional area. Both machines being fully equipped with the necessary clamping arrangements for suitably holding the work, and in charge of first-class mechanics of long experience, and between whom considerable rivalry existed, the exceedingly favorable results from the milling machine in comparison to the planer are somewhat surprising, even to those who know it best.

Eight pieces of cast-iron 18 inches long, having a surface 8½ inches wide and one and one-fourth inches down each side, to be rough finished on the face and to size on the sides, are done on the planer in four and one-half hours, the pieces being placed in two rows on the platen, and both heads being used simultaneously.

The time required by the milling machine is just forty-one minutes for the same number of pieces, straddle-mills being used, and one piece being operated upon at a time; the amount of metal removed being about one-sixteenth in both cases.

Another class of work is cast-iron strips 16 inches long, ¼ inch thick and 1½ inches wide, to be rough finished all over. The best time made on the planer was found to be at the rate of four every thirty-six minutes, while the milling machine turns out six every six minutes. Still another class of work, where narrow strips, having lugs on their outer ends, are to be finished smooth and to size on the lugs between them, and one inch inside of them, on the flat surface. The best time on record from the planers was four in twenty-eight minutes; the milling machines' daily records give us eight of them every four minutes. The planers in this case are small modern machines carrying single heads, and having a platen speed of twenty-two feet per minute. The spindle of the milling machine is one and three-fourths inches diameter, and makes thirty-four rotations per minute, while the platen travels thirteen inches during the same interval, the platen travel having been doubled after coming to the works from the builders without increasing or affecting the cutter rotation. Another item of importance brought out is the fact that the cutters are colder, and retain their cutting qualities longer, since the speed of the platen has been increased, and the work forced harder against their cutting points, thus conclusively demonstrating to the author that it is frictional contact which tends to destroy and dull the cutters, and

* Read at the New York meeting of the A. S. M. E.

not the actual work performed. Memoranda kept during the past year also indicate the cost of renewals for cutters and grinding to be about twenty-five per cent. less than the running expenses for planer tools.

The most important practical result discovered and brought about by the milling machine, after it was fully in service, was the total abandonment of three planers and one shaper previously used on this work, all of which now goes to the miller, an increase in the capacity of shop production of nearly thirty per cent., at the same time bringing about a better uniformity of work than could possibly exist under previous conditions, and, lastly, creating a reduced pay roll, not from reduced wages, but because fewer men are employed.

To the author these figures are neither conclusive nor satisfactory. I feel assured from recent experience that the platen travel of this machine can be increased to twenty inches per minute under the present conditions for roughing down work to "oversize." And I am also convinced that a milling machine can be built that will take off metal at the rate of thirty-six inches per minute—nor need it be so very high in purchase price, either. Of course, it is understood that I am referring only to cast iron; steel and wrought-iron would be slower proportionately.

There are to-day a thousand and one varieties of work being slowly done on planers which should be rapidly worked on milling machines; but the machine to do this must be designed and patterned closely upon the lines of the modern planer, and must universally reach over and around the work on the platen, and also be as easy to handle and operate as the present planer. If twenty minutes are required to clamp a piece of work on the planer, and it takes one hour to plane it, while the miller mills it in twenty minutes, but an hour is used and lost in clamping; the latter becomes the expensive machine, and all the argument is in favor of the planer.

I have said nothing about the "overhung" arm type of milling machines in this paper, as it covers a field of its own, competing only with small planers, slotters and shapers, doing nice work and reasonably rapid, but as yet far within its possibilities, the reasons being chiefly that it is lacking in rigidity and strength in its component parts.

Pattern Makers' Supplies.

The Diamond Clamp and Flask Works, of Richmond, Ind., have gone into a new line of business, which they call "pattern shop supplies." Among the articles which they are making, and which are specially designed to facilitate the pattern makers' work, are wood corner strips for making fillets, these being made of $\frac{3}{4}''$, $\frac{5}{8}''$, $\frac{1}{2}''$, $\frac{3}{8}''$, $\frac{5}{16}''$ and $\frac{1}{4}''$ radius; these are made in lengths of 4 feet, and are slightly out of square, to adapt them to the draft of the pattern.

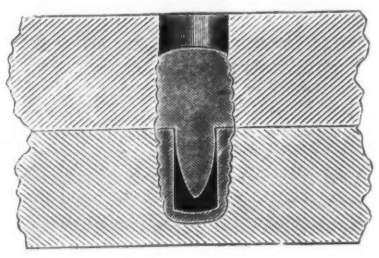
Flexible strips are also furnished, but it is found that about three-fourths of the fillets are straight, and, when straight, these wood strips, that can be nailed or glued, can be used.

They make also a line of malleable rapping plates, which are readily fastened to any pattern, bits being furnished for facilitating the operation of putting them on.

Our illustration shows the latest form of dowel pin made by this company, and it will be noticed that it is so made that a hole can be bored of uniform size through both parts of the pattern before separating them, thus insuring accuracy in the position of the pins. Saw tooth grooves are formed out side, which allow the pins to be readily driven in, and hold them securely when in place. They are made of brass, in three sizes.

Grinding Machine.

The accompanying illustration is of a new machine for miscellaneous grinding operations, built by the Sterling Emery Wheel Co., 174 Fulton street, New York City. In this machine the countershaft is supported by the frame, as shown, so that the machine is entirely self-contained. The length of the spindle is 36"; distance between wheels, 25"; diameter of spindle in bearings, $1\frac{5}{16}''$; diam-



DOWEL PIN.

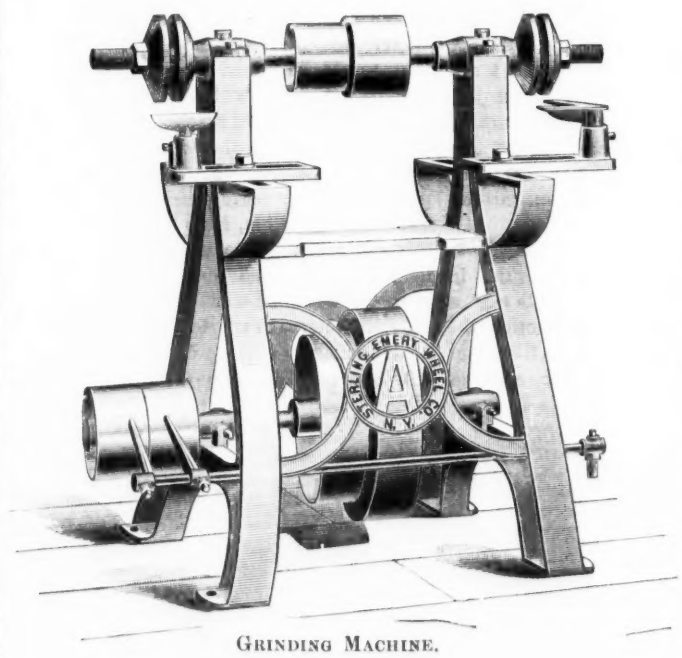
eter of spindle between flanges, $1\frac{1}{4}''$; length of bearings, 6'. It is intended for two 16" wheels and weighs complete 300 pounds.

Practical Details of Blacksmithing.

BY B. F. SPALDING.

FLOW OF SOLIDS—HOW PRODUCED—EFFECTS OF BLOWS—CONDITIONS AFFECTING BLOWS—EFFECTS OF STEADY PRESSURE—UPSETTING COLLARS—ELECTRIC HEATING—HEATING OF DIES—FORGING MACHINES—UPSETTING PIPE CONTRACTING CARTRIDGE CASES AND BAYONET SOCKETS—UPSETTING CARTRIDGE RIMS—NICKEL-LINED TUBES.

The principle of forging in close dies, whether it is done with the drop or any other machine, is that coherence, or cohesive attraction, in solids, yields under pressure, until their particles move as in fluids, glacier like. They may be moved to a distance, but in motion they change partners under a coercion, which assures the security of new affiliations before the dissolution of the old.



GRINDING MACHINE.

When iron or steel is subjected to pressure proportionate to its hardness, it will be forced to flow in the direction of the least resistance, and by filling up vacant spaces in the dies will be conformed to the shape of the dies. Under the pressure, the red-hot metal flows as truly as melted iron, poured from the ladle in the foundry, flows into and receives the shape of the molds.

If a mass of iron sufficient to fill the dies is placed in them, and struck or pressed with sufficient force, it will fill them, and they will impress their form upon it, whatever may have been the shape it bore before being submitted to the pressure. It is evident that to acquire this form its particles must move, one upon another, in the manner of fluids, for the material does not disintegrate; on the contrary, it becomes more densely compacted.

To produce the effect of greater fluidity, and cause the metal to fill and take the impression of the dies more distinctly, one of a number of expedients may be employed, according to the peculiar requirements of the particular case: either the pressure may be increased, or it may be more quickly applied, intensified by shortening its duration, or one of the founder's methods may be adopted, that of making the metal hotter.

The founders appply the term "sharp" to hot metal; they say they pour it "sharp" when its fluidity has been so increased by heat that it will take sharp and clear impressions from the mold. The use of the term is only sanctioned by custom. So in forging, where the term is not applied to heats as commonly as it is to blows. A sharp blow has relatively more velocity than mass in its momentum.

The weight of the hammer must be great in proportion to the dimensions of the metal which is to be subjected to its action, in order that the effects of the blow may extend throughout the mass; and for this reason, the largest hammer in the world, the great 125-ton hammer of Bethlehem, recently described in the AMERICAN MACHINIST, was necessary to work the 18-inch armor plates which are being made for the U. S. government.

On unconfined metal, a sharp blow exerts its immediate force on the surface. If such a blow is struck on a piece of iron which is large in proportion to the weight of the hammer, the side of the iron which is struck will be most affected, and the side resting on the anvil the least. When it is struck on metal confined in a die it may affect the upper side first, but if the force is sufficient it will be transmitted throughout the metal, and may produce a sharper impression than a heavier blow, or one of the same momentum, but compounded of more mass and less velocity.

A light hammer, falling a longer distance, will dash the metal into more intricate cuts, and fill shallow dies better than a heavier hammer falling a less distance; but in deep dies the reverse is true. In sharp blows some of the force appears as available heat, and raises the temperature of the piece smitten. Some forgings in deep dies can be made to better advantage by a pressure which is practically uniform during the whole period in which it is exerted than by a blow, the force of which is constantly diminished by resistance from the moment of impact until it is entirely absorbed. This is because a pressure, which is not too quick in its action to be conveyed from particle to particle, will affect the particles at a distance nearly as much as those contiguous, and all will be acted upon in a similar manner; while a quick blow, on a long reach of stock in a die, would affect the portion of stock it first struck upon, and swell it out, so that it would fill the die at the entrance, and choke it there so tightly that the force would be spent more in compacting the plug than in useful work on the stock beyond.

Sharp blows are notorious die breakers.

If a collar, say half an inch square, is to be upset, or raised up on a shaft one and a half inches in diameter, the location of the collar on the shaft, and the conditions of obtaining the heat, must both be considered to determine the character of the force which would be suitable to drive it up. If it was on or near one end, and the heat was to be taken with fuel, it is probable that a longer portion of the bar would be heated than 2 or $2\frac{1}{2}$ inches, which would give half an inch working leeway on one or each side of the amount required to throw up the collar; and a sharp blow might be used, while a short, close heat, such as is within the province of electricity to produce, would not give as much advantage to a blow of that kind.

If it is required to raise the collar at a distance of three inches from the end, and the heat is to be raised with fuel, the advantage is altogether on the side of a stroke of constant pressure; but if the heat can be raised by electricity at the proper place, distinctly limited in its length, and without much shading of its boundaries, a sharp stroke will produce good results, and will not subject the dies to an injurious continued action of the heat given off by the shaft.

As the endurance of dies is of some importance in the matter of economy, it must be borne in mind that the closer the contact is made between hot and cold metal, the more rapidly will the conduction of heat take place. When a blacksmith wants to take the temper out of the too sharp corners around the hole in his new anvil, he does not pick up some old tool, heat it, and set it loosely into the hole. No! for then he would not communicate heat faster than the conducting power of the metal would convey it away and diffuse it, but he fits a hot plug into the hole and drives it down hard, to make as close contact as possible, so as to get the heat into the corners faster than it can get away, and raise the heat close to the hot plug. This is exactly what is done when hot iron is driven into dies; the most effective method ever discovered is taken to heat them. This is as undesirable as it is unintentional, and the shorter the time in which the hot iron is allowed to remain in contact with the dies, the less will be the injury which it inflicts.

In such work as this, where the pressure is applied endwise on bars, the convenience of handling the pieces is altogether in favor of horizontal forging machines, in preference to drop hammers. If they are built strong enough to be safe to run at the quick speed which it is sometimes expedient to use, they are, without doubt, among the most profitable machines which have been devised to facilitate the operations of forging. The dies need not be unduly exposed to heating; and arrangements are handily made to direct a small stream of water upon them, by which they are kept cool.

Owing to the difference in the manner of applying the force, to the difference in the effects of steady pressure and a blow, less material is needed for each die, in proportion to the size of stock worked upon, than would be necessary for making dies for doing the same work with the drop. A drop hammer must have an excess of force, which, if not used in work, is, nevertheless, spent as waste, but in a forging machine no more force is spent than is utilized.

An operation which is performed by one of these machines is a little out of the common run of forging, and is remarkably well done. It is the upsetting of the end of a piece of steam pipe which had in it, originally, an inch and a half round hole, and making about two inches of the pipe to have an inch square hole in it, leaving the outside of the pipe of its original size, which, as the stock was some $\frac{5}{16}''$ thick, would be about one inch and seven-eighths in diameter. This is the kind of forging to which the application of force by steady pressure is peculiarly adapted. It is a little out of the common run, because the stock ordinarily worked upon by blacksmiths is solid, and when they upset a piece, the portion congested must be expressed, or swelled outwardly; but in this hollow form of stock, the thickness which is gained by driving it together and shortening its length is used on the inside, in filling up four sides of the $1\frac{1}{2}''$ hollow cylinder with segments of an inch and a half circle, an inch across and two inches deep.

This pipe is upset something over an inch and a half, in order to get the necessary stock to fill in around the inch plug, which projects in front of the inch and seven-eighths plunger, which does the upsetting. The pipe, after being heated on the end in a furnace which heats 5 to 10 per minute, is made fast in a die which fits it on the outside, and the plunger is immediately driven forward, the inch plug entering the pipe. As the

plunger moves onward, the hot metal which is thickening up, being restrained by the dies from pressing itself outward, is constrained to go into and fill up the space on the inside which is not occupied by the square plug. It fills it so completely as to leave a very smooth, nice and square hole when the plunger recedes. Beyond the square hole, the size of the round hole is somewhat diminished, as an excess of stock is allowed, to make sure of having enough, and the excess is shown by the amount which the round hole closes. Enough stock could be upset to close the hole completely. The pipe suffers no deformity on the outside, there is no tendency to collapse; the pressure is uniform and outward against the die, which suggests that collars may be upset on pipe without the use of a mandrel.

Something about working tubes can be learned from the experience of the cartridge case makers. Woods, the inventor, received some thousands of dollars for a device for contracting the front third of the length of a certain style of cartridge cases. The reduction was from fifty one hundredths of an inch, in the rear, occupied by the powder, to forty-five one hundredths, at the front, to fit the ball. The scheme was simply to make the case in the ordinary way, of the full size of the rear end, and afterwards to press it into a hole which gradually contracted to the required size. The case was forced endwise into the hole, and the end had to contract to get there. There was no tendency to cripple, and it proved to be a perfectly practical operation.

Another curious operation on a tube was one performed at the United States Armory. There came to be a great accumulation of bayonets on hand, which, owing to some change in the barrels, were too large in the socket by a sixteenth of an inch. Dies were made to fit around the sockets and in the slottings, and they were cold-pressed together that fraction, with a power press, at a very slight expense.

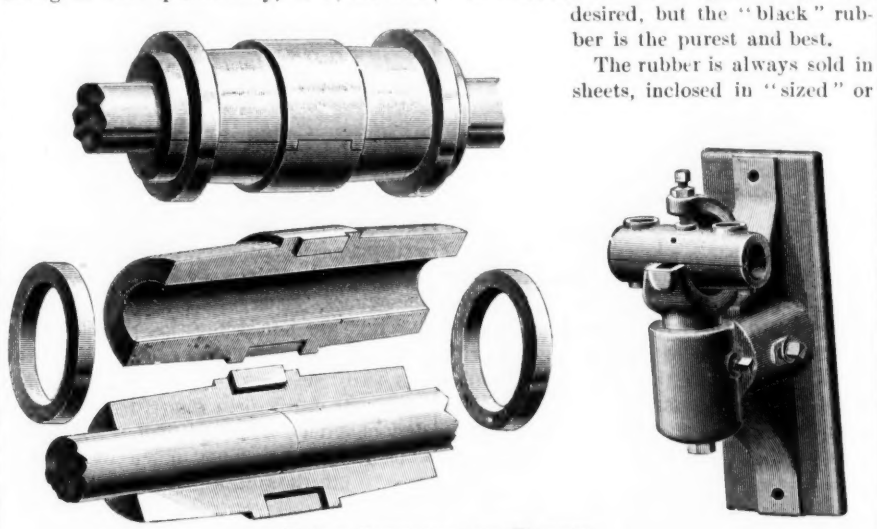
The making of the rims of cartridge cases is a good example of upsetting tubes to make an outward enlargement. A plan proposed for reinforcing a machine gun cartridge case with a steel washer at the rim made a double ridge. The plan was to upset a slight ridge in front of the washer, and to upset the usual rim back of the washer, both to be done simultaneously, while the steel reinforcement was in its proper place, where they would thus secure it. This was practical, but not as ingenious as another plan, which was to make the whole rear end of steel, and nickel-plate it, and stick it on a steel former which was the size of the inside of the case. On this former was a loose, or what is called a "peeling" deposit, of nickel. On this, as a cathode, the proper thickness of copper was electrically deposited. A rolling process separated the loose nickel with its copper covering and steel back from the steel former. The result was a nickel-lined copper case, with a steel rear. The operation was successful in the laboratory, but was not proved practical on a commercial scale. The plan was a modification of a method by which the electrician, Mr. Luther Smith, who devised it, succeeded in producing surgical speculums of any size, of superior excellence.

Shaft Coupling and Hanger.

We present herewith engravings of a post hanger and of a shaft coupling made by the Cordesman Co., Cincinnati, Ohio.

The post hanger, while strong and substantial, permits complete adjustment, both horizontal and vertical, the latter being effected by applying a wrench to the bolt head seen below the cup. There is also a vertical and a horizontal swiveling movement, thus affording every means for adjustment.

The coupling is very simple in form, consisting of four pieces only, *i. e.*, the two halves which interlock, as shown, and are tightened on the shaft by driving the two rings into place upon the conical ends. Thus there are no set-screws or projecting keys, and the coupling is easily put in place or removed.

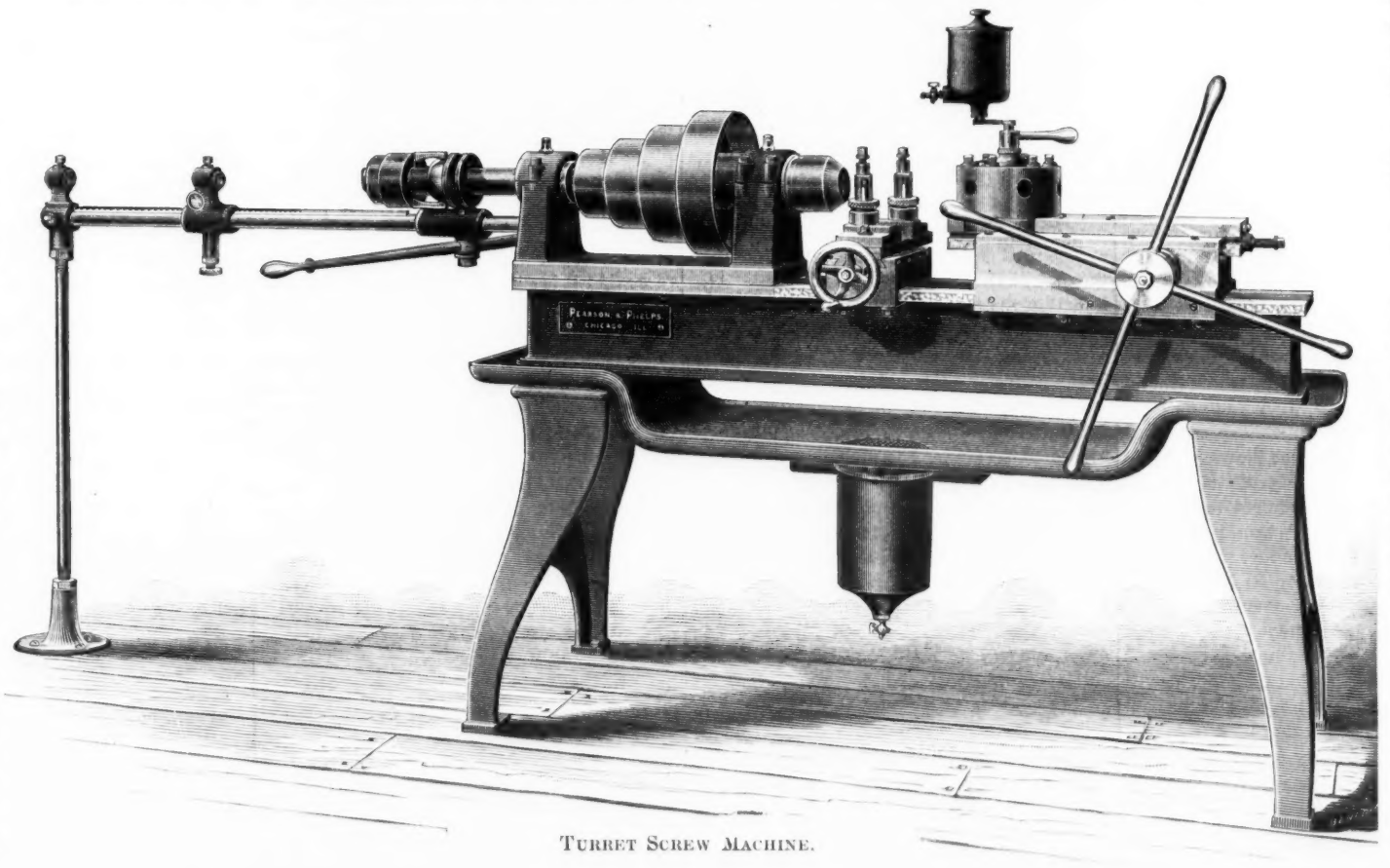


SHAFT COUPLING AND HANGER.

Turret Screw Machine.

We illustrate herewith a new 16" screw machine brought out by Pearson & Phelps, 20 N. Des Plaines St., Chicago. It is a machine of unusually heavy design, and will, it is thought, meet the approval of manufacturers who are aiming to do heavy work upon turret head machines. The spindle is of tool steel and has a $1\frac{9}{16}$" hole through it. The front bearing is 3" diameter by $4\frac{3}{4}$" long.

The machines are built either as turret lathes or screw machines, with or without wire feed, automatic chuck, plain back gear or geared friction head.



TURRET SCREW MACHINE.

Rubber Pattern Work.

BY JOHN T. USHER.

PACKING THE MOLDS.

Any kind of rubber that has been prepared during the process of manufacture for "vulcanite" or hard rubber work will be found suitable for making rubber patterns. The cost of the rubber may vary from $2 to $3.50 per pound, according to the kind purchased (or, rather, the "brand" name under which it is sold).

Rubber purchased by the writer in ten-pound lots was found to be equal to most of the higher priced brands, and suitable in every way for this purpose.

The rubber can be bought of any color desired, but the "black" rubber is the purest and best.

The rubber is always sold in sheets, inclosed in "sized" or "glazed" linen covers, to protect the rubber from the atmosphere and light; the rubber must, therefore, be kept so inclosed until needed for immediate use, as it is liable to deteriorate and to get dirty by being exposed. Care must be taken not to allow any grease or dirt to get on those edges and surfaces of the rubber which it is desired should unite or flow together with other edges or surfaces. (The rubber is said to liquefy at a temperature of 240° Fahr., gauge pressure 10 pounds.)

When the plaster molds have been prepared as already explained, the mold surfaces proper may be coated with "liquid silex," which can, as far as I am aware, be obtained only at the dental depots; but as this coating is the best I know of for plaster mold surfaces, I should advise its use whenever it can be procured. In case the "liquid silex" cannot be had, then the next best thing to use is "collodion." This can be procured at any drug store. This latter must be kept tightly closed, as it evaporates very quickly, and must not be used too near a flame or fire, as it is also highly inflammable. It is also better to buy it in small quantities (five or ten cents worth at a time).

The metal mold surfaces may be coated with powdered soapstone, or talc is better; the "soapstone" or "talc" are better adapted to this purpose, however, when the vulcanizing has to be done in dry heat vulcanizers; the "silex" or "collodion" is preferable in every instance.

The molds are packed in the following manner:

When the body of rubber in the pattern does not exceed $\frac{1}{8}$" in thickness, as per the half door knob pattern (Figs. 17 and 18), and the base plate pattern, Figs. 21 and 22 (AMERICAN MACHINIST, May 12, 1892), it will only be necessary to put into the mold a quantity of rubber just sufficient to fill the mold when the flask is bolted together. Usually after a little practice the amount of rubber necessary to fill almost any mold may be gauged to a nicety without having any surplus whatever. In the meantime, one of the two following methods may be adopted as a measure of safety:

First. After having put into the mold what would be considered a sufficiency of rubber, take a piece of the linen cloth (in which the rubber was wrapped) large enough to cover the mold surface (of the half mold into which the rubber has been packed) with some to spare, wet it and lay it over the rubber in the half mold. Then place the other half mold (or flask) in place on this, put in the bolts and screw the nuts down with the fingers, but not as yet applying any undue pressure on the same. The flask is then placed in a pan or kettle of boiling water (or in any hot place having about the same temperature) and left there for a few minutes, until the flask and contents are heated to the temperature of the boiling water; it can then be taken out; and while yet hot the nuts are to be screwed down evenly all round, screwing each nut down a little at a time, and repeating this until the whole are screwed down; when this has been done the nuts are to be unscrewed, the bolts taken out as quickly as possible and the flask opened. The cloth with which the rubber in the mold was covered can now be removed, and the surplus rubber, if any, can be cut away with a warm knife or spatula all around the mold. Should there, on the contrary, be a deficiency of rubber in the mold it will be plainly indicated, and the deficiency can be made up by adding more rubber. Should the above-mentioned cloth stick to the rubber in the mold upon opening the same (which it will do if the cloth has become dry), it may be readily removed by dipping this half of the mold in the hot water again to wet the cloth. When the surplus rubber, if any, has been removed, or the deficiency, if any, made up, the plaster mold surface (not the one with the rubber in) can be coated again with the "liquid silex" or "collodion," whichever is used, and the flask put together again, the bolts replaced, and, if necessary, the flask may be re-heated before the nuts are screwed down tight; when this

has been done it is ready to be vulcanized.

Secondly. If preferred, several grooves or depressions may be cut out in the plaster investment (which, for want of a better term, I will call surplus holes), around and away from the edges and surfaces of the mold proper, at the most convenient points in one or both halves of the investment, in such a manner as not to endanger the stability of the molds, and then to connect the mold and the "surplus holes" by an escape channel through which the surplus rubber may escape into the above-mentioned "surplus holes," making the "escape channels" shallow near the molds and enlarging them as they approach the "surplus holes." The mold is then packed with rubber as before, being sure of having a sufficiency of rubber in them (as the flask is not to be opened again), but, if possible, avoiding having any surplus, for economy's sake. The flask is then put together, the bolts inserted therein, and the nuts screwed down with the fingers; the flask and contents are then heated by placing it in boiling water or elsewhere, as before, after which the nuts may be screwed down tight, and it is ready for the vulcanizer.

To pack the shell (and every similar) pattern, Figs. 26 and 27 (May 12), pieces of rubber are to be cut off in strips, and after being heated over a Bunsen burner or otherwise (anywhere except over a smoky flame), to soften it somewhat, a quantity sufficient to fill the space between the "mold" and the "cone" is to be closely packed therein, on that side of the mold in which the cone is located, using the tang of a small file or similar shaped instrument to pack the rubber in with. For the other (open) half mold, enough rubber can be placed therein to insure a sufficiency for that half of the mold, and a little in addition to supply any deficiency that may occur in the half mold already packed. Then put the flask together and proceed as before.

When the body of rubber forming the pattern or any part thereof exceeds $\frac{1}{8}$" in thickness, as per the enlarged end or base of the "acorn nut" pattern, Figs. 31 and 32 (October 6, 1892), and the hub or boss (through which the square spindle passes) of the (half) "door knob" pattern, Figs. 33 and 34 (October 6), a different method to that given for the preceding examples must be followed or adopted when packing the molds, as, in vulcanizing masses or bodies of rubber which exceed $\frac{1}{8}$" in thickness in plaster molds, it will almost invariably be found, when such bodies have been vulcanized without taking or adopting special means to prevent it, that the body of rubber has become porous or blown, which is caused by the accumulation or generation of some gas inside the body of rubber during the process of vulcanization, as per Fig. 35, which shows sectional cut of a rubber pattern, which should be the same as the half door knob pattern, Figs. 33 and 34, but which, as no precautions were taken to prevent it, was blown with the result shown. The porosity of the rubber would of itself be no detriment to the patterns, but, on the contrary, would be an advantage, were it not for the fact that it also causes the body of rubber to become enlarged and to bulge out, compressing the plaster molds and investment to make room for the enlargement. To prevent the porosity or enlargement mentioned above, it will be necessary to either put a cone in the center of the body or mass, or otherwise to separate the layers of rubber forming the same by introducing or placing pieces of cloth or paper (if the latter would not be apt to get torn or separated, thus forming a connection), between the different layers of rubber. The hub or boss of the inner half door knob pattern was cored in the following manner: A piece of old rubber tubing was cut off a little less in length than the hub and about $\frac{1}{8}$" less in diameter. Inside of this piece of tubing a cork was pressed (to fill up); then on the outside a layer of rubber was wrapped, the whole was then pressed into the mold; the body of the pattern was then packed as per the outer half door knob pattern, Figs. 17 and 18 (March 17, 1892), or as any ordinary pattern. The acorn nut pattern, Figs. 31 and 32, was packed by placing a layer of rubber in each half of the flask, and filling the center in with pieces of old rubber hose or tubing. Of late I have been using paper for the purpose of filling in the centers or coring any articles similar to those described above. I form the cores and centers as follows: I take a piece of paper, the width of which equals the length of the hub or body to be cored, less $\frac{1}{4}$", and then, after wetting the paper, roll it up as solid as possible until it approximates about $\frac{1}{8}$" less in diameter than the outside diameter of the hub or body, then around this I put a layer of rubber (the ends of which will readily unite on coming in contact with each other if the rubber is clean; in fact, one piece of rubber will always unite with any other piece instantly wherever and whenever they touch if the rubber is clean and not too stiff), and press it into position in the mold. For flat or plane pieces or bodies it is only necessary to fold the paper, after wetting it, to the size required as compactly as possible, and then either to wrap a layer of rubber round it and press it into position in the mold, or otherwise to first put a layer or layers of the rubber in the mold, and then press the core into the center of this, placing a layer of rubber over it also, packing the rest or thinner parts of the mold, if any, in the usual way. This makes the best core of any I have yet tried, and is so simple that no one will find any difficulty in making cores by this method very rapidly, nor is it necessary to remove the cores after the patterns have been vulcanized.

In packing such patterns as the base plate

RUBBER PATTERN WORK.

pattern, Figs. 21 and 22, that are connected by a gate which must of necessity, for obvious reasons, be very much reduced at those parts or points of the gate where it is joined to the pattern, a piece or strip of thin sheet copper may be embedded in the gate and also in the approximal ends of the patterns, to strengthen the gate at the above mentioned points. Also in making patterns which are to be grouped together, as per Figs. 12 and 14 (Feb. 18th), a strip of sheet-copper may be imbedded in the pattern at the point or points desired and left overhanging for attachment to the gates (which are to be made separate) by means of screws. The mold, or rather the investment surrounding the same, must be cut away for the copper strip to lie in, otherwise the overhanging position of the same will prevent the mold from coming together.

When metal molds are used it will only be necessary in packing them to put as much rubber into the mold as will fill the same; provision can be made for the surplus by cutting or filing one or more escape channels at any and as many points as desired, continuing them to the outside of the mold. When the metal molds have been packed as above and the bolts inserted therein, they can, after being heated (as explained elsewhere), be squeezed or pressed together in a "vise" or "press" if preferred, though usually the bolts will suffice. There is no danger of the rubber being "blown" when vulcanized in metal molds, and even if the rubber was "blown" in a metal mold, no harm would be done, as the pattern would still retain its correct form or shape. A press must not be used for squeezing the flasks and molds together when the molds are made of plaster.

THE BULBOUS SYSTEM.

By this method a bulb or shell is produced by creating a pressure on the inside of the article that is being made during the process of vulcanization, thereby expanding the rubber and forcing it against the mold surfaces with whatever pressure is generated therein. Different sections or "gores" (as they are termed) are cut and joined together, as may be seen on examining a hollow rubber ball or toy, which are always made by this method I will give the method that is always followed by makers of hollow rubber wares, and also the method I have adopted as being somewhat easier than the above.

By the first method mentioned, patterns or templates are made for the different sections or "gores" required to form the article to be made. A sheet of rubber is then taken, and if not already prepared, powdered "talc" or "soapstone" is rubbed on the outside of it, one or more "sections" or "gores" are cut to each of the "patterns" or "templates" as required. The different sections or "gores" are then placed one upon another, the "talc" or "soapstone" preventing the surfaces from sticking together. The edges of the different "sections" or "gores" are then, after being heated over a Bunsen burner, united or joined by squeezing them together with the fingers, the rubber as explained before readily uniting when the surfaces are clean and of recent exposure. Sometimes, however, the "sections" or "gores" are joined together with a special cement made for the purpose. When this has been done a piece of small tubing (a pipe-stem will do) is then inserted at the point desired and a "bulb" or shell is formed by expanding the sections united by blowing into the same until the article is about the size required to fill the "mold." A little water, or sometimes ammonia water, is then poured into the "bulb," the tube withdrawn and the opening closed, after which the "bulb" is placed in the "mold," the "mold" closed, the bolts inserted and tightened up, and it is ready for the vulcanizer. The steam which is afterwards generated from the water inside the "bulb" causing the rubber to expand and press closely against every part of the "mold" surface during the vulcanizing process.

Considerable practice will usually be required by this method before any very satisfactory results may be expected. The following method which the writer has adopted will be found much simpler and more satisfactory to those having had no prior experience with this class of work.

Take one-half of the "mold" to be packed, coat it with "silex" or "collodion." Then take a sheet of "rubber," cut off a strip or piece that it is thought will reach across one end of the half mold, and without putting any "talc" or "soapstone" on the rubber, place it in position in the half mold, pressing it with the fingers closely down on the mold surface. Another strip of rubber may then be cut off and laid alongside of the first piece in the half mold, the edge of the second piece slightly overlapping that of the first piece, and so on until a layer of rubber has been placed or formed in this half of the mold enough to cover the mold surface proper. The edges of the different pieces or strips are then joined by heating the "wax spatula," Fig. 16, and rubbing this over each one in turn, pressing them together until they are united. The "rubber" may then be trimmed off around the upper margin or edge of the mold surface, leaving the rubber protruding above the edge about $\frac{1}{16}$". This protruding portion is then to be spread over and away from (outwards) the upper edge or margin of the mold surface; a strip of rubber $\frac{1}{4}$" wide and the thickness of the sheet rubber is then laid upon this overlapping portion of rubber in the mold; some water is then poured into this half of the mold. When the other half has been packed in the same manner (with the exception of the last narrow strip of rubber being omitted in this instance) this half of the mold is carefully placed in position on the first half, thus closing the mold, the bolts are then inserted and tightened up (or down), and it is ready for the vulcanizer. The overlapping of the rubber on the upper edge of the half molds, together with the additional narrow strip, causes or makes a perfect joint or union of the two halves of the "bulb" when the mold is closed and squeezed together. A couple of small holes are afterwards drilled in the "bulb" after it has been vulcanized, to run the water out; these holes are then filled or plugged up with "sealing wax" or "gutta percha."

Bulbs can only be made in metal molds; as the plaster molds will not stand the high internal pressure generated during the process of vulcanizing the rubber.

It will be found a much more difficult matter to produce good work, or to make shell patterns by the bulbous system, than by coring, and the success attending the use of this method is (except in the hands of expert rubber workers) of such an indifferent nature that I do not feel warranted in advocating its use. I consider the making of shell patterns by coring, as already explained, to be much more satisfactory. A very large variety of solid patterns, such as the "washer" and the "handle" patterns, *a*, *a'* and *b*, *b'*, Figs. 1 and 2 (Oct. 15th, 1891), can, if desired, be made of gutta percha. If made of this material no vulcanizer will be needed. It will only be necessary to warm or heat the gutta percha, and then pack as much of it into the mold as required. The mold is then closed, the bolts inserted (as already explained for packing with rubber), the flask or mold and contents is then re-heated, the bolts tightened up, after which the flask or mold can be immediately cooled off, and the pattern taken out. The "gutta percha" and also the flask or mold and contents can be heated in boiling water.

Also, if desired, these and all similar patterns may be made of the kind of rubber used for making rubber hand stamps, tubing, etc., etc.

This kind of rubber never vulcanizes harder than the rubber tubing, etc., and for those patterns for which it can be used it will be found to be fully equal to the "hard rubber." It is also cheaper, and has this advantage over the "hard rubber." It will not blow in vulcanizing, (or at least I have never known it to blow), and a pattern can therefore be made solid throughout, no matter what the thickness may be, if the form of the pattern is such that it can be used for making the same, without the liability of the pattern being afterwards warped in ramming up the mold when it is used. Another and a very decided advantage which this kind of rubber has over the "hard rubber" (where it can be used) is that it can be vulcanized without having any special vulcanizer, or appliance for the same purpose, other than the flask in which the mold is made or invested, if plaster molds are used, or the metal mold if the latter is used, though, of course, where a vulcanizer is available, it is better to use it.

After the mold has been packed and bolted together it may be put into the vulcanizer, or on a hot stone, or anywhere where the flask (mold) and contents can be slowly heated to a temperature of from 284° to 320° Fahr. for a space of from four to twenty minutes, according to the make of rubber, and the thickness of the article to be vulcanized.

The vulcanizing temperature must not fall below 284° Fahr., nor, if possible, exceed 320° Fahr.

LETTERS FROM PRACTICAL MEN.

Patent Laws and Regulations.

Editor American Machinist:

In your issue of October 20th, 'Patent Lawyer" expresses his opinion quite pointedly that my article in your issue of October 6th was "way off," but he does not give his reasons for so thinking. Instead, he seems to have depended upon his ability to misrepresent the article of October 6th—a thing that I believe lawyers as a class are experts at doing.

Now as my arm has become rested I will try to continue my "great invention" as it was originally started, and try to show that there are good reasons why the government should protect property consisting of patented inventions.

The first thing "Patent Lawyer" jumps upon is the statement I made that there are

dishonest patent lawyers who encourage any foolish thing in order that they may get a fee for procuring a patent—a patent that the lawyer knows will be of no value to his client.

Now "Patent Lawyer" cites a case in which, as he states, he advised his client not to try for a patent, and says it is a similar case. I wish "Patent Lawyer" would read the article of October 6th carefully, and see if he can find anything in it for an *honest* patent lawyer to get mad at.

Perhaps it was not a good idea for me to make suggestions about patent law, I being a mechanic, not a lawyer. Still I shall have to differ with "Patent Lawyer" in this respect. I have in some way got the idea that a citizen of the United States has a right to complain and make suggestions, regardless as to whether he is an eminent lawyer or a member of the legislature. I will admit that I overlooked one thing, and I am glad that "Patent Lawyer" has called attention to it. A patent should be allowed to an "Hon." for the sake of accommodation, especially where the "Hon." has sold the patent and spent the money; but, Mr. "Patent Lawyer," should not such patents be marked with the word *accommodation* in large red letters, so that when a person is looking over the *Official Gazette* for practical things, he may be saved the labor of studying into things of the *accommodation* kind?

"Patent Lawyer" wants to know what harm it does to issue patents on useless inventions. Perhaps the best way to answer this question will be by asking another: What is the Patent Office doing business for—is it for fun, for benefit to the country, or for the purpose of supporting the government?

I don't know that any one will complain about the issuing of what I call accommodation patents if they would be so marked and printed in a separate *Gazette*, but I complain that the great growth of the business in the Patent Office is not of the kind that will benefit the country much in the way of making useful new inventions available to the public after the seventeen years' time allowed to the inventor. If the government would give better protection more useful inventions would be patented. Is not the grand object of the Patent Office to afford protection to an inventor for a while, under the conditions that at the end of this time the invention will become public property?

Now, Mr. "Patent Lawyer," what does the public want of an invention for hitching a horse, for instance, that requires two policemen, two horse doctors, and two machinists and a horse to work it to advantage? When the Patent Office will allow a patent on such a subject, does it not look as though they had lost sight of everything except the $35?

I hope "Patent Lawyer," being a lawyer, and so in better position to make suggestions than I, will suggest to others of his profession and to legislators that they get larger hammers and strike harder blows, and see if they can't make some impression, instead of just hammering.

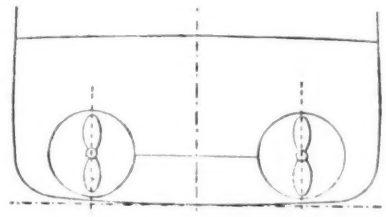
Inventions that have to be brought to the eyes of the public, such as, for instance, a lamp, watch, saw, knife, where everybody has a chance to understand just what the new feature is, I believe as a general thing are patented; not that it gives good protection, but because it is the best that can be done; but inventions that relate to a process of manufacture which are often of the most valuable kind, things that would be of great value to the country; in fact, the very things that patent laws should promote, are now kept secrets by some of the most level headed manufacturers, for good reasons. A patent, I believe, does not differ very much from a deed of a piece of real estate.

A man may own a piece of real estate just the same before he gets the deed as afterward, but the deed is his title, and a man who has spent money and worked at perfecting an invention owns that invention just the same before he gets a patent as afterward, but the patent is his title from the government. Now in the case of the real estate, if anybody sets fire to the buildings, or in other ways destroys his property, or steals or appropriates, the government will foot the bills in prosecuting and punishing that party. Now in the case of the property consisting of a patented invention the owner has paid more for his deed than the owner of the real estate, but when the whole invention is stolen outright he is entitled to no protection from the government, but must protect himself, and if his wealth will not reach so far then the offender goes unpunished and the citizen is wronged; but according to "Patent Lawyer" it is all right. "Eminent lawyers and legislators have hammered away at it." I am not telling of things that do not happen. Here is a case that has happened, and I think I can find lots of them. A party about five years ago perfected and patented at no small expense an invention. It was a practical thing, and just what was wanted for the purpose. Another party started to manufacture this thing just about as soon as they could after finding out about it, and would not and will not to this day recognize the inventor's claim at all. The inventor has tried hard to come to some settlement without carrying the matter into the courts.

Lately I understand the manufacturer has informed him that he may sue him if he wants to. This is quite a privilege, is it not, Mr. "Patent Lawyer"?

"Patent Lawyer" seems to want to tell us that any patent is worth $17,500,000, but this one is a pretty good one, and I believe it is not actually worth more than $1,000.

Now let the inventor carry this matter into the courts and have it linger there three or four years; all this time the manufacturer has the use of the invention.



The inventor may win the case and he may lose, depending much, I believe, upon how much money the other side feels disposed to furnish. At any rate, he will have to spend the value of the patent, perhaps much more.

Now are there not good reasons why he should not sue, good reasons why he should give his property to a thief, good reasons why he should accommodate him with another patented invention as soon as he calls again? I tell you, Mr. "Patent Lawyer," a U. S. patent makes a regular despot of a man. It opens up a way for him to give away all of his inventions, and then throw all the money he has earned at breaking stone and sawing wood into the heap after them. I will tell you of a case that had to do with other property, money in this case. A friend of mine had a small amount of money stolen from him in the city of Bangor, Me. He notified the police. The thief was caught, tried, and punished by one year's imprisonment without my friend having to pay a cent. The money was recovered and returned. Now if my friend had been obliged to pay all expenses (as he certainly would have to do if it was a patent instead of money that was stolen), including the thief's board while in jail, would there not have been good reasons why he should want the thief to go free, good reasons why, if caught, he should try to influence the judge to make his time short in jail? "Patent Lawyer" is lucky in having a contented mind.

He can dream of inventions worth $15,500,000, while he tries to collect $25 from the inventor. If the government should take $35 from me for which they would undertake to insure me good health for seventeen years I should expect them to pay my doctor's bills, and pay me for my time while sick during the seventeen years. About pensioning inventors, paying inventors a salary, and a few other things mentioned by "Patent Lawyer," if he will in some way connect these things with the subject I will try to reply.

A MECHANIC.

Blue-prints—Aluminum—Cam Rollers.

Editor American Machinist:

I would like to mention in your columns my difficulty with blue-prints, hoping that some of your readers may volunteer information. In preparing prints for the machine shop I paste them on heavy cardboard and apply two coats of white shellac varnish. This treatment insures a surface from which dirt and grease may be wiped with a wet sponge, but it will not take the Helios fluid if a correction is to be made. Can any one suggest a preparation which will make water-proof lines on such a surface?

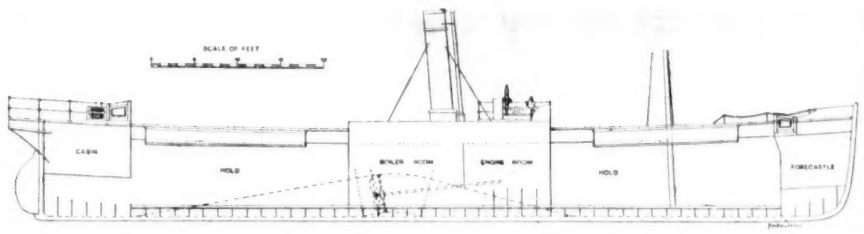
When by reason of improvements in design the prints become obsolete it is desirable to paste new prints over the old ones; would like to hear from some one who can suggest a paste or glue that will adhere to the hard, smooth, varnished surface; have tried several kinds without success.

Has anything been done in the line of blue printing by electric light? Doubtless many draftsmen have, like myself, been seriously inconvenienced by being unable to get prints in rainy weather.

Have any members of the craft used aluminum drawing instruments? Would like to know if they smut the paper, and also address of the manufacturers of such tools.

Referring to the remarks of Mr. Durfee on cam rollers, in your issue of 10th inst., I would like to suggest that the probable reason for many designers using roller *R* in preference to *R'* is that the latter, from its wedge shape, would cause thrust on the lever, which in some cases is more objectionable than the wear due to the theoretical inaccuracy of roller *R*.

Battle Creek, Mich. W. S. LEONARD.



THE TWIN-SCREW STEAMSHIP "TUBULAR."

The Twin-screw Steamship "Tubular."

Considering the amount of attention which the propulsion of vessels by means of screw propellers has attracted for some time past, it will perhaps be of interest to our readers to learn that Messrs. Cochrane & Cooper, of Beverley, near Hull, have recently constructed a vessel, illustrated herewith in section in Figs. 1 and 2, which, it is claimed, is likely to revolutionize the means of propelling vessels so far as river and canal traffic are concerned. The object of this method of construction is to enable steamers to be propelled at a fair speed on rivers and canals without causing back-wash, which is so injurious to the banks and to small craft. It is stated that a premium has recently been offered in America for a steamer which would fulfill the above-mentioned conditions, and that the "Tubular" has been constructed, after extensive experiments, with a view to securing this premium.

The dimensions of the "Tubular" are: Length, 94 feet; beam, 18 feet 6 inches; and depth of hold, 8 feet. She is fitted with compound surface-condensing engines, having cylinders 9 inches and 18 inches diameter with 13-inch stroke, capable of developing 125 I. H. P., and estimated to drive the vessel at a speed of 10 knots. As will be seen from the illustrations, the vessel is constructed with two tubes 4 feet 6 inches diameter, running longitudinally with and placed about the middle of the hull. Inside, and at about midway in the length of these tubes, the screw propellers are placed, and are connected with the engines in the usual manner. This vessel has been constructed for the Tubular Twin-screw Amidships Propulsion Company, Limited, of York, and is intended for trading between Hull and York. She has a deadweight capacity of 180 tons.—*Industries* (London.)

That Coal Affidavit.

Mr. Charles Parish, of Wilkesbarre, Pa., has made an affidavit which was filed in the Court of Chancery of this State, on Tuesday, in which are several statements that may be more or less important. Mr. Parish is the president of two or more coal-mining and coal selling companies, and he swears that, if the present rate of consumption of coal is continued, the entire supply of coal in the Pennsylvania coal fields will be exhausted within the next one hundred and fifty, and probably one hundred years; he also swears that the consumption of coal is extravagant and wasteful, that the methods of mining it are even more wasteful, and that the low prices of coal that have prevailed for two years past have been very disastrous to the public. We do not, however, notice that Mr. Parish swears that the existing conditions have been disastrous to the coal companies. It would have been interesting if Mr. Parish had given in his affidavit the figures of the dividends and profits of the owners and operators of the coal mines, and had demonstrated to the satisfaction of the buyers and consumers of coal that the increase of the price of this necessary article of consumption was justifiable. If the coal-mining business is carried on in a wasteful manner, it is for those who own and operate the mines to amend their methods. If the people who burn the coal are extravagant in its use, that don't hurt Mr. Parish or any other coal producers or coal sellers, provided the coal is duly paid for. As to the future anticipated coal famine a hundred or a hundred and fifty years hence, that need not worry either Mr. Parish or any of his customers. If the coal supply gives out there will be some other and perhaps better fuel than coal found, and possibly it will cost the people of the coming generations less than coal costs us now. What the public would like to know is whether the parties who now control the coal supply are treating their customers fairly by supplying coal at a price which gives the coal merchant a fair profit and does not unduly burden the coal consumer, or are without any justifiable reason limiting the production of coal and exacting from the buyers an exorbitant price.—*Evening Journal* Jersey City).

Our attention has been called to an error which occurred in our remarks about the modern steamship, the statement having been made that the Great Eastern was made of wood. As a matter of fact, as nearly every one knows, the vessel was of iron, and on one of her trips to this country she struck a rock, in or near this port, and tore a hole in her hull, which was repaired by boiler makers who worked within a wooden box, which was made large enough to cover the opening, and with one side open, the edges of this being made to fit the hull. The water being pumped out of this, the boiler makers were enabled to enter and work thus under water, there being, of course, no dock facilities which would answer for such a vessel.

The increase of the capital stock of the Western Union Telegraph Company, said to have been made with a view of the ultimate sale of that corporation to the government, has given rise to the rumor, no doubt true, that the stock of that company now held by the Baltimore & Ohio Railroad Company is being negotiated for by the Western Union. Baltimore & Ohio Railroad officials say that, if they sell, the sale will not be made until after the stock dividend is paid, about December 1.

AMERICAN MACHINIST

Communications relating to the reading columns should be addressed to the Editor. All other communications should be addressed:

AMERICAN MACHINIST,
203 BROADWAY, NEW YORK.

PUBLISHED WEEKLY AT
203 Broadway, New York.

HORACE B. MILLER, Pres't and Bus. Manager.
LYCURGUS B. MOORE, Treas. and Sec'y.

F. F. HEMENWAY, Editor and Mech. Engineer.
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$4.00 a year to Other Countries, postage prepaid.

Advertising.

Transient, 35c. per line, each insertion.
"Business Specials," 50c. a line.

The American News Company,

Publishers' Agents, New York.

DEALERS SUPPLIED BY

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Subscriptions received in Paris, France, by E. TERQUEM, 31 Boulevard Hausmann, at 20 francs per annum, postpaid.

Subscriptions received in Australia by W. WILLIAMS, 17 and 21 Fink's Buildings, Melbourne.

NEW YORK, DECEMBER 1, 1892.

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Engineers in the Navy.

At this writing, the Secretary of the Navy has under consideration a case which is of very great interest to all who are in the engineer department of the navy, and the decision of which will, it is hoped, go far towards settling some of the difficulties, and removing some of the causes of friction between what are known as the "line" and "staff" officers of the navy. We have before called attention to the fact that the modern naval vessel is nothing more nor less than an elaborate machine designed for fighting, and placed upon a floating foundation. This being the case, it is inevitable that the engineers and mechanics who understand this machine, and can make it do what it is designed to do, should come more and more to the front, because the issue of a battle will depend in a constantly increasing proportion upon their intelligence, special knowledge, and ability to use this special knowledge unhampered by red tape, and the unreasonable restrictions of those who, in the nature of things, can know next to nothing regarding the nature of the duties which must be performed by engineers.

The case briefly stated seems to be thus: Assistant Engineer Danforth, of the "Philadelphia," was in charge of the engine room of the cruiser, and was conducting a test of the capstan steam pipe, which test had been ordered by the chief engineer, with the approval of the captain of the vessel. During this test, the master at arms appeared in the engine room, and started to take a machinist named William Dunlop, who was engaged in the work, to the mast. He was stopped by engineer Danforth, who said that men ought not to be taken from the engine room without his knowledge, even in pursuance of the orders of the officer of the deck, which the master at arms claimed he was following. The master at arms seemed offended at this, and reported to the officer of the deck, who apparently gave up his demand for Dunlop, and sent for engineer Danforth to report to him on deck. Engineer Danforth, who, in the meantime, had himself sent Dunlop to the mast, refused to leave his work to report on deck, on the ground that he was responsible for the work then going on, and that the officer of the deck, and, in fact, no one, except the captain of the vessel or the chief engineer, could relieve him of this responsibility. He was then sent for by the executive officer, and immediately responded, as he considered that an order from that source relieved him of all responsibility for the work in his department. Within an hour after this, charges had been formally made against him, and he had been denied all opportunity to make any explanation whatever of the reason for his refusal to respond to the call of the officer of the deck. The trial just ended was for his alleged refusal to obey the lawful order of his superior officer.

The mere statement of this outline of the case is sufficient to show to any one who has any experience with steam machinery and its management, the anomalous, not to say utterly absurd position in which an engineer of the navy is placed by the present rules and regulations of the service. It needs only the commonest kind of common sense to perceive that it is vitally necessary for an engineer who is in charge of work going on in an engine room to know that, when he places a man in a certain position, and gives him certain duties to perform, he will remain in that position, and perform those duties, and not be liable to be taken away by any other authority without the knowledge and consent of the engineer in charge of the work. The proprietor of any factory recognizes this principle as vitally important to the safety of his plant and of himself, and it would seem as though any one, with the possible exception of a naval officer, ought to recognize that to attempt to establish any other principle is the very quintessence of foolishness. In this particular case the taking away of the machinist Dunlop from his position, without the knowledge of the engineer in charge of the work, would probably not have resulted in any very serious consequences, the vessel at the time not being under way, and the test of a steam pipe not being a very difficult matter; but the principle admitted, that any officer of the deck who may happen to be on duty may send for any member of the engineer force at any time, and require him to report on deck immediately, regardless of circumstances, and without reporting to his superior officer, then the engineer officers of a naval vessel ought to be relieved entirely of all responsibility except to blindly obey orders from the deck, no matter if such an order may be known to be liable to cause the explosion of a boiler or the complete wrecking of the engine. Any one outside the navy knows very well that no engineer whose orders given to his subordinates are liable to be countermanded by a superior authority can properly be held in the least degree responsible for the conduct of his department. In other walks of life this principle has long been well understood, but in the navy, tradition, red tape, and the apparently intense fear entertained by the officers of the line that some of their authority, dignity and importance may be taken away from them if any one else on board a naval vessel is allowed to exercise any discretion or is given control of anything whatever even though it be something which in the nature of things the line officer can know nothing about, stands in the way of the recognition of this plain principle of common sense, and results in friction between the engineer and other officers of the navy, which it seems to us may well be almost unbearable, and which has led to the resignation of many engineers, while others stand ready to embrace the first opportunity for leaving the service.

When the broad general principle that future naval battles will be contests of machines, in which the best machines, handled in the best manner, will be victorious, and that these machines can be well handled only by men who thoroughly understand them and are given control of them, being held responsible for results only, then engineers and machinists can serve in the navy with some degree of enthusiasm and interest in their business. This principle is bound to be recognized some day, but in the meantime the navy would seem to be a good place for engineers and machinists who have ability, ambition and self-respect to keep out of.

Since writing the above, and just as we go to press, we learn that Secretary Tracy has approved the sentence of the court, *i. e.*, that Danforth is guilty as charged, and that he be suspended for one year on half pay with loss of rank. We shall comment upon this next week.

A senatorial committee in session in Chicago, for the purpose of investigating the Pinkerton and other detective agencies, elicited from a detective some very significant testimony regarding the business. The witness, Robert Bruce, is described by the press dispatches as being the manager of a detective agency. He testified that he would not believe a detective under oath, and, upon being asked whether he would apply that to himself, said that he would, and that "in strikes detectives were often induced to manufacture evidence, as their employers would imagine they were doing nothing if they failed to report progress of some sort." He declared further that the "Pinkerton men were usually the scum of the earth, and that one of Pinkerton's superintendents was an ex-convict!" The men of other agencies were, he declared, no better as a rule.

This testimony of a detective, taken in connection with what has been known before in regard to these agencies, should be considered by employers who may be thinking of hiring such men to go among their employes and ascertain whether or not there is dissatisfaction among them, and whether there is liability of a strike or other trouble. As we have said before, we believe that by far the best plan is, first, to do the fair thing, and at least as well as other employers in the same line are doing; then to be candid and entirely fair-minded in the discussion of any question which may arise, and to prefer the word of an honest mechanic or laborer rather than that of a so-called detective who may make it a part of his business to manufacture evidence, and who is by nature opposed to work and workmen. So far as our observation extends, we have never known such a course to fail in producing good results, while we have known the opposite course to produce friction and trouble in very many instances. In any event the employment of detectives seems to be a very good way to cause trouble or to intensify that which may already exist.

From the fact that when a collision of railroad trains occurs, in which the ordinary and the Pullman cars are both concerned, the Pullmans are usually comparatively uninjured, it is being argued that trains should be composed of cars which are, like the Pullmans, sufficiently strong to resist the force of a collision. It is probably true that stronger cars would reduce the amount of damage and the number of fatalities, but to assume, as some seem to assume, that it would almost do away with damage or fatalities in case of collisions, is, we think, erroneous, for the reason that the force exerted in striking by a body which is in motion depends very much upon the resistance encountered, and upon the distance within which the stored energy in the moving body is absorbed after the first contact. Where there are weak cars in a train, these, by crushing and gradually giving way, reduce the force exerted upon the stronger ones very materially. If cars could be constructed which would be absolutely unyielding when striking together, it is safe to say that not a living person would be found within them after a collision at any considerable speed.

Mr. W. R. Waggener, Professor of Natural Philosophy at the State University of Colorado, at Boulder, has issued a circular letter in which he advocates the plan of printing engravings used to illustrate text-books and other publications on sheets of transparent gelatine or celluloid. This printing is to be done independent of and in addition to the printing of the engravings in the book, and the sheets so printed should accompany the book, so that they may be used in a lantern for projection upon a screen for use in the class room or in lectures. Prof. Waggener has tested the plan sufficiently to prove its entire practicability, and thinks that by putting the engravings for a book together upon a printing press, and printing them upon large sheets of the transparent material, which are afterwards to be cut up for use, it can be done quite cheaply. He hopes to see the plan generally adopted, and makes the suggestion for what it is worth.

Any one who has ever taken the trouble to look into the matter has found that men who drive and conduct street cars are usually made to work unreasonably long hours for very small pay, and when there is a strike for the purpose of improving matters or to resist further encroachments, they usually have the sympathy of the public. The latest proposition is to place in street cars mail boxes, not for the convenience of the public, but so that the chances of the men winning in contests with the companies will be reduced. It is doubtful if the Postmaster-General can be induced to lend his aid to such a scheme, but if he should do it we should say that he would be using the power of the government in pretty small business.

QUESTIONS AND ANSWERS.

Questions of general interest relating to subjects discussed in our columns will receive attention in this department. The writer's name and address should always accompany the question. Neither correct initials nor location will be published when there is a request to that effect. If questions are enclosed with a business communication, they should be written on a separate sheet.

(516) P. P., New York, writes: Can you inform us if the soot of steam boiler pipes is used for any purpose, polishing, for in-

stance. *A.*—We have no doubt that soot is used in some of the industrial branches, although we cannot at present recall any particular instance; but we believe it is not used for polishing.

(517) G. H. C., Belleville, N. J., writes, In answer to T. C, Detroit, Mich., Question 476, in your issue of November 10, current volume, will say that if he will write to Messrs Peck & Snyder, 126 to 130 Nassau street, New York, he will secure what he is looking for, at a cost of from $40 to $60.

(518) W. A. S., Montclair, N. J., writes: Please answer the following through your columns: A. claims that the front side of an anvil is the side at which the smith stands when working. B. claims that the front is the one at which the helper stands. Which is right? *A.*—B. is correct. See answer to Question 467, in our issue of November 3, current volume.

(519) M., Hartford, Conn., writes: A friend of mine has a boat 22 feet long, 4 feet 6 inches wide, with a 2½ x 3 inch engine running at the rate of 400 revolutions per minute and using steam at 200 pounds pressure. The boat makes about 5½ miles per hour. I propose adding a cylinder 5 inches diameter and making an upright tandem compound condensing engine of it. What should be the power of such an engine properly constructed? *A.*—About 5 horse-power.

(520) J. R. G., Philadelphia, Pa., writes: Please inform me of a method of silvering sheet brass which is stamped with figures, such as clock dials, etc. I would prefer a wash to the battery process. *A.*—In the *Scientific American* Cyclopedia of Receipts the following is given: The first essential is that the metal be chemically clean, which is best done by the use of dilute nitric acid, followed by a wash with clean water, and then with dilute aqua ammonia, drying in sawdust. If the metal be then rubbed with chloride of silver dissolved in water, and then washed and again dried in sawdust, the result will be fine. It should, however, be immediately lacquered, in order to preserve the surface.

(521) L. T., Penn Yan, N. Y., writes: I have invented a new engine for which six cylinders are to be used; the steam is to be admitted at one end only. I would now like to have your opinion. Will the steam at 200 pounds pressure, admitted to the upper ends of these cylinders for one-eighth of their strokes, lose its heat and pressure during the other seven-eighths of the stroke, so that at the end of the stroke a good system of condensation will handle the exhaust steam to produce a vacuum? Or can I admit steam at 200 pounds, one-fourth or one-half stroke? Or must I cut it off at less than one-eighth stroke? Please just say in your answer, ¼ or ⅛, or the proper point of cut-off. *A.*—During expansion the steam will of course lose heat and pressure, and there will be no difficulty in handling the exhaust. Steam should be cut off at about $\frac{1}{12}$ or $\frac{1}{10}$ of the stroke. We have no faith in your design of engine, and in our opinion you will not accomplish what you have set out to do.

(522) J. P., Rochester, N. Y., writes: Please inform me through the Question and Answer columns if there is a way to put blueprints in the printing frame without doing so in the dark room? And is it good practice to take them out and wash them in the light? I know but very little about them, and wish to try my hand at it. *A.*—Blueprints are not generally put in the printing frame in a dark room. Before you take the prepared paper out of a dark place, place the tracing in the frame with its face touching the glass, and have everything ready to receive the paper, which must be placed with the prepared side touching the tracing, then close the frame and expose to the light. The paper will not be injured if you lose no time in putting it in the frame. The prints are always washed in a light room; the lines will become fixed as soon as the paper is submerged in water, and it should not be taken out until the lines become white, or until the yellowish tint, which appears after putting the paper in water, is washed off.

(523) J. M. D., Toronto, Can., writes: I have some car wheels to make which have to be chilled on the rim and afterwards annealed. The thickness of the rim is about 1 inch. How thick should the chill be? *A.*—About 3½ inches. 2. About how long should they be submitted to heat, and how hot should they be made, or what is the best way to anneal them? *A.*—The castings are taken out of the mold as hot as possible, and at once placed in an annealing pit and left there for three days with fire underneath, allowing the fire to gradually cool off. You will obtain a better idea of the process by visiting a foundry in which car wheels are cast. 3. Can wheels be successfully made without annealing? *A.*—No. 4. If you have thrown any light on the subject in the columns of the AMERICAN MACHINIST, kindly state number of issue. *A.*—We have not given a complete description of the process, but we expect to do so within a few weeks.

(524) E. B., Erie, Pa., writes: In your issue of October 20, Question 448, the moment of inertia of a cylindrical bar is given as being equal to $\frac{\pi d^4}{64}$; Haswell gives .7854 r^4. Please state which is right. I find the results are the same for a 2-inch bar, but for a 1-inch bar there is quite a difference. *A.*—It seems to us that you have made a mistake in copying Haswell's formula; in our copy of Haswell we find the moment of inertia of a cylindrical bar to be equal to .7854 r^4; this gives the same result as $\frac{\pi d^4}{64}$; both are correct, and either one can be used. 2. Is the moment of inertia used in other computations besides those for finding the stresses due to transverse forces? *A.*—Yes. 3. Under what conditions is the modulus of elasticity used? *A.*—It is used in computations relating to the deflection of beams, columns, etc. 4. Kindly name a book that thoroughly explains the above and kindred terms used in computing the strength of materials—one that can be understood by one having a knowledge of elementary algebra. *A.*—"Mechanics of Material," by Mansfield Merriman; and "Elementary Applied Mechanics," Part 2, by T. Alexander and A. W. Thomson, are excellent books to have.

(525) C. H., Mittweida, Germany, writes: Please inform me through your columns if foreigners, that is young men of Dutch parentage, would be admitted as students in the United States Naval Academy, and what knowledge a person must possess to enter it; also the fees. I am a student in mechanical engineering in one of the colleges in Germany, and a careful reader of your paper. *A.*—You will have to become a citizen of the United States before you can be admitted. You must also be recommended by a member or delegate of the House of Representatives. The rules are: There shall be allowed at the Academy one naval cadet for every member or delegate of the House of Representatives, one for the District of Columbia, and ten at large, provided, however, that there shall not be at any time more in the Academy appointed at large than ten. The candidate for the District of Columbia and all candidates appointed at large shall be selected by the President. Candidates allowed for congressional districts, for territories, and for the District of Columbia must be actual residents of the districts or territories respectively from which they are nominated, and all candidates must be, at the time of their examination for admission, between the ages of fifteen and twenty years, and physically sound, well formed, and of robust constitution. Each cadet will be required to sign articles by which he binds himself to serve in the United States Navy eight years, including his time of probation at the Naval Academy. In regard to the examination which candidates must pass, and other particulars, see answer to Question 75, in our issue of February 25, current volume.

(526) J. D., College Rock, Cal., writes: I want a little information relating to electric plants. I am night engineer on the electric railroad; I have had six years' experience in the machine shop, but this is my first engineering job. I am 23 years of age, and a freshman in the college here. I want you to give me the names of some good books treating on electricity. *A.*—Probably the most useful and practical work for you to use under the circumstances is "Street Railways, their Construction and Maintenance," by C. B. Fairchild. There are many other good works which treat on the subject from a theoretical standpoint; some of these have been noticed in our columns. It seems to us that the professors in the college should be able to give you better advice than we can. 2. Now the most important question I want you to answer is, Which do you consider to be the best engine? We are going to put in a 150 horse-power engine in place of another one, but have not decided what kind to get. We want the best kind of engine, and one that will give the best satisfaction in the long run. *A.*—We will not recommend any engine in preference to others, either through our columns or privately. The best way is to engage the services of a first-class mechanical engineer; let him study the conditions under which the engine has to work, and the work required of it; he will then undoubtedly recommend the most suitable engine, and one that will give the most satisfactory results. In selecting an engine many things have to be taken into consideration, and no one is better qualified to judge than one who has had experience in arranging steam plants, and whose honor and reputation is at stake in case of failure. Do not attempt to make the selection yourself, unless you have the necessary qualification to do justice to your employer.

(527) C. A. C., Buffalo, N. Y., writes: What should be the diameter of an idler shaft, say about 3 feet long, on which is a spur wheel 48 inches in diameter; it is in gear with a spur wheel 30 inches diameter, and another 100 inches diameter. The smaller wheel has to transmit 22 horse-power, running at a speed of 15 revolutions per minute. Please give formula for computing the above. *A.*—We shall assume that the 48-inch wheel is keyed to the shaft, with a journal on each side of the wheel. In computations of this kind we have to make the journals large enough so that they will not heat; this will generally give a shaft strong enough to resist all the forces acting upon it. To prevent heating we must know the pressure on each journal, which is found in the following manner: The wheel has to transmit 22 horse-power or $22 \times 33{,}000 = 726{,}000$ foot-pounds per minute; the circumference of the small wheel (30 inches in diameter) is 7.85 feet, and in making 15 revolutions per minute the speed at the circumference will be $7.85 \times 15 = 117.75$ feet per minute; hence the force transmitted will be $\frac{726{,}000}{117.75} = 6{,}165$ pounds; the pressure on both journals of idler shaft is equal to twice 6,165 pounds, or on one journal we have a pressure of 6,165 pounds. The pressure per square inch of the projected area of the journal should not exceed, say, 300 pounds, consequently the area of the projected area should be $\frac{6{,}165}{300} = 20.55$ square inches. If now the length of the journal is to be three times the diameter, and if we designate the diameter by d we then have

$$d \times 3\,d = 20.55, \text{ or } 3\,d^2 = 20.55;$$

from this we get

$$d^2 = \frac{20.55}{3} = 6.85;$$

$$d = \sqrt{6.85} = 2.61,$$

say 2⅝ inches for the diameter, and $2\frac{5}{8} \times 3 = 7\frac{7}{8}$ inches for the length of journal. Good judgment guided by experience must be exercised in selecting the pressure per square inch of projected area; 300 pounds per square inch may be taken when the pressure is on top of the journal; when the pressure is on the bottom a greater value per square inch may be adopted. For very high speeds a smaller value may have to be taken, and the length of the journal will have to be four times the diameter, or even more, as experience may dictate.

(528) L. C. M., Wilkes Barre, Pa., asks: What is the volume of the space between the threads per pitch or per revolution of a screw of the following dimensions? Outside diameter, 12 inches; diameter at the bottom of thread, 3 inches; pitch, 6 inches; thickness of thread, 2 inches; see sketch. *A.*—The volume between the threads per revolution can be approximately found in the following manner: Assume the space between the threads of the screw to be filled with, say, lead; this will form a bar coiled around the cylindrical core *C*, Fig. 1. The cross-section of this bar is equal to the rectangle *a b c d* in Fig. 2; and the area of this cross-

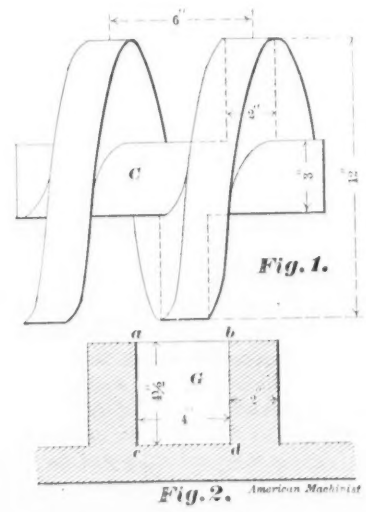


Fig. 1. Fig. 2. American Machinist

section, multiplied by the length of the bar which extends just once around the core will be the volume of the bar, or, what amounts to the same thing, the volume of the space between the threads. Let the point *G* be the center of the section *a b c d*; assume a line to extend through this point along the whole length of the bar. This line will form a helix whose diameter in this example is 7½ inches, and in extending once around the core it will have a pitch of 6 inches. The length of this line will be approximately the length of the bar. The length of the line through the center *G* will be equal to the hypothenuse of a right-angled triangle whose base is equal to the circumference of a circle 7½ inches diameter, and whose height is equal to the pitch (6 inches). The circumference of this circle is 23.56 inches; hence the hypothenuse of the corresponding right-angled triangle will be: $\sqrt{(23.56 \times 23.56) + (6 \times 6)} = 24.31$ inches. The area of the cross-section *a b c d* is equal to $4 \times 4\frac{1}{2} \times 18$ square inches, and $18 \times 24.31 = 437.58$ cubic inches for the volume of the bar or space between the threads for one revolution. This result is a little in excess of the actual volume of the space.

BUSINESS SPECIALS

Transient Advertisements 50 cents a line for each insertion under this head. About seven words make a line. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue.

Prices greatly reduced. See Grant. Page 20.

Shafting Straighteners. J. H. Wells, Tampa, Fla.

Ideal Drawing Stands. M. C. Hammett, Troy, N.Y.

Forming Lathes. Mer. Mach. Tool Co., Meriden, Ct.

$10 Countershafts. A. D. Pentz, Elizabeth, N. J.

Tool Holder: Armstrong Bros. Tool Co., Chicago.

New lists of cutters. Brown & Sharpe.

"Bradley's Power Hammers, the best in the world." 20 sizes. Bradley & Co., Syracuse, N. Y.

The Improved Justice Hammer. Williams, White & Co., Moline, Ill., manufacturers.

Pattern and Brand Letters. A variety of sizes and styles. Heber Wells, 8 Spruce St., New York.

Drill Presses, with Tapping Attachments.
Gould & Eberhardt, Newark, N. J.

Davis Key-Seating Machines kept in stock by Manning, Maxwell & Moore, 111 Liberty St., N. Y.

Selden Packing for stuffing box, with or without rubber core. Randolph Brandt, 38 Cortlandt St., N.Y.

S. A. Smith, 23 S. Canal St., Chicago, Ill., is agent for Standard Tool Co.'s Twist Drills.

Pulley lathes, most efficient offered. The Lodge & Shipley Machine Tool Co., Cincinnati, O.

Castings for small and medium-sized vertical engines. Humphrey's Foundry, Bellefontaine, Ohio.

Guild & Garrison, Brooklyn, N. Y., manufacture steam pumps, vacuum pumps, vacuum apparatus, air pumps, acid blowers, filter press pumps, etc.

"Shapers (Double Triple Quick Stroke")
Trade Mark.
Gould & Eberhardt, Newark, N. J.

For the Latest Improved Diamond Prospecting Drill, address the M. C. Bullock Mfg. Co., cor. Canal and Washington Sts., Chicago, Ill.

Patterson, Gottfried & Hunter, Limited, 146-150 Centre st., New York, are putting on the market a new alarm speed indicator. Send for circulars.

We electrotype illustrations and advertisements for manufacturers. Prompt and thorough service. Send for estimates. A. Mugford, Hartford, Conn.

Gear Cutters, Auto. Specially adapted for Motor Gears and all other style Gears.
Gould & Eberhardt, Newark, N. J.

S. W. Card & Co., Mansfield, Mass., are putting on the market a new line of stocks and dies, with their patent adjustable dies and guide. S. A. Smith, 23 S. Canal Street, Chicago, Ill., Western Agent.

Patent Soliciting of High Class.
D. Walter Brown, Counsel in Patent Cases,
31 Nassau Street, New York.
Send for Brief History of Patent Legislation.

De Lamater Screw Propeller Wheel, made only by The Samuel L. Moore & Sons Co., Elizabethport, N. J., who have purchased from C. H. De Lamater & Co., New York, all their patterns, books of record, gauges, etc. Location and equipment well adapted for Heavy Steamship Repairs.

"Binders" for the AMERICAN MACHINIST. Two styles—the "Common Sense," as heretofore sold by us, and mailed to any address at $1.00 each, and the "New Handy," mailed at 50c. each. The former has stiff board covers, while the latter has flexible covers with full page opening flat. Either will hold the entire 52 issues of any volume. AMERICAN MACHINIST PUBLISHING CO., 203 Broadway, New York.

"Indicator Practice and Steam Engine Economy." By F. F. Hemenway. Contains plain directions for using the indicator and making all required calculations from the diagram, also the principles of economy in operating steam engines and current practice in testing engines and boilers. Price, $2 postpaid. Published by John Wiley & Sons, 53 East Tenth Street, New York.

Notes on Rope Driving—II.

BY M. E.

Loss due to Differential Driving Effect.—We will now briefly consider what is generally regarded as the principal source of loss of efficiency in independent rope transmission, viz.: the differential driving effect due chiefly to inequality in the diameters of the ropes. There can be no question that a large percentage of the loss is to be traced to this cause, but it is equally true that much may be done to reduce it, by giving careful attention to the rope installation in the first place. It is obvious that, for the best results, each set of ropes should be of the same make throughout and exactly of the same diameter; also that they should all commence working at the same time, be of a perfectly uniform length, and be all similarly spliced. Uniformity of length is an important requirement, as from the previous remarks it is evident that, if one rope of a set is allowed a less amount of sag than the others, the pressure forcing that particular rope into its groove will exceed that to which the other ropes are subjected. It will therefore be drawn deeper into the groove, the "pitch diameter" of which will in consequence be reduced, with the result that, if the driving and driven pulleys are of unequal diameter, the velocity ratio which this rope tends to impart to the driven wheel differs from that imparted by the others of the set. The actual resulting velocity ratio will be a mean of the several efforts of the different ropes, so that slipping of the more heavily stressed rope occurs and

power is lost, due to the differential driving thus set-up, and lost, moreover, in wearing out the rope.

It will be readily seen that in a set of ten or a dozen ropes, each of a somewhat different length, the loss of power from this cause may easily become a very serious item, and to this there is to be added the correspondingly diminished life of the ropes. A similar action occurs when worn ropes are allowed to work conjointly with new, even though the sags, and therefore the tensions on the several ropes, are practically equal. In this case the loss due to abnormal tension and wedging of some of the ropes into the grooves is avoided, but the differential driving effect due to the ropes virtually running on pulleys of different diameters still exists, and is equally objectionable. It may here be noted that the effect of the differential driving upon the ropes depends to a very large extent upon the relative diameter of the two pulleys. It is evident that, when the driving and driven pulleys are of the same diameter, any variation in the effective pitch diameters of the several grooves will have no appreciable effect upon the transmission, provided that the diameter and shape of the corresponding grooves in the two pulleys are the same. It may be noted, however, that the worn ropes which run deeper in the groove, having a slightly less velocity, are subjected to a somewhat greater stress than their newer and larger companions.

When the driving pulley is smaller than the driven, any inequality in the rope diameters tends to correct itself. To illustrate this let A be the driving and B the driven pulley in Fig. 3, which represents the assumed condition, but very greatly exaggerated. If r is $\frac{1}{3}r_1$, then the smaller ropes n will tend to drive B in that ratio, while the larger ropes m, riding at a distance x higher in the groove, will have an effective radius of $r + x$ on the driving pulley, but only one of $3r + x$ on the driven pulley, instead of $3\,(r + x)$. It is therefore clear that a larger rope will take more than its share of the load, while a smaller rope will in consequence be relieved of some of its work. By reason of this the new ropes will be rapidly stretched and worn, so that any initial variation in tension due to difference in rope diameter will soon be automatically corrected. Of course, while this equalizing process is going on, loss of power will be incurred, but in other respects this is the arrangement which, under otherwise favorable conditions, best insures equal tension and wear of the ropes.

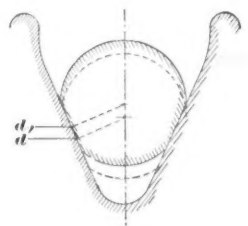


Fig. 5.

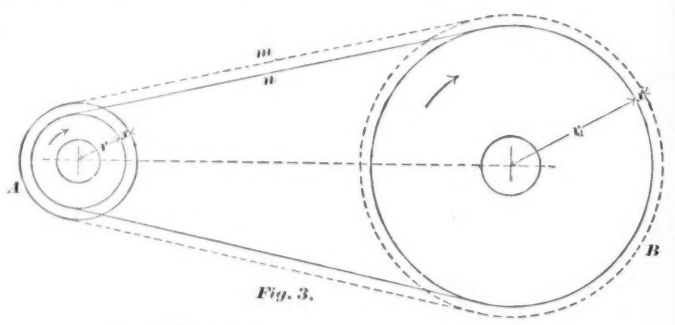


Fig. 3.

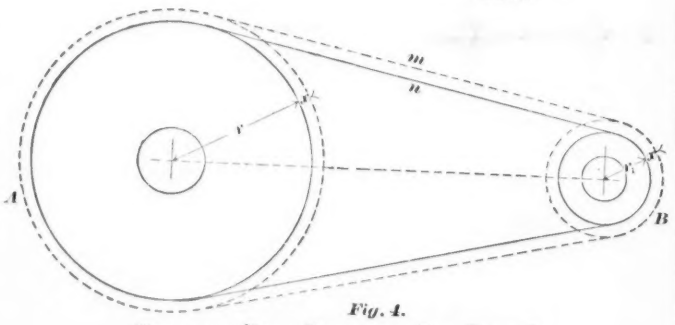


Fig. 4.

NOTES ON ROPE DRIVING.—SEE PAGE 9.

When the driving pulley is larger than the driven—as is almost invariably the case in cotton-mill driving and electric light work—the action is such as to cause the larger ropes to take less than their share of the total power, while the smaller and weaker ropes are in consequence unduly loaded. From Fig. 4 it will be seen that now the smaller ropes n tend to drive B at three times the speed of A, while the larger ropes m will endeavor to drive B at less than three times the speed of A, since they act at a radius $r + x$ and run onto a radius of $\frac{r_1}{3} + x$, instead of $\frac{r_1 + x}{3}$. In this way more than their share of the work of transmission is imposed upon the smaller ropes, while the load on the new and larger ropes will be correspondingly diminished. In this case there is therefore a tendency to aggravate the loss due to differential driving, since the action described will have the effect of increasing any existing inequality in the diameters of the ropes. In this connection it should be noted that the action above described increases with the velocity-ratio of the two pulleys, with the number of ropes, and with the ratio of the diameter of the ropes to that of the pulleys.

In practice, the axial rotation of some of the ropes will frequently exert a modifying influence in the two latter cases, since, other conditions being unchanged, a rope which rotates will work less deeply in its groove than one which does not turn about its axis in working. In the latter case the rope assumes an approximately triangular shape, and the effective pitch circle of the pulley becomes relatively smaller than when the rope rotates. Of course, while in contact with the pulleys the revolving ropes are flattened to some extent, as indicated in Fig. 5, but they recover their circular form when free of the pulleys. On the other hand, those ropes which do not rotate naturally conform more to the shape of the grooves in which they run; and, the sides becoming flattened to a considerable extent, the ropes work lower in their grooves, and virtually run on pulleys of different pitch diameters, as indicated at d d_1. From what has been said in the foregoing, it will be apparent that, when the larger pulley is the driver, those ropes which have any tendency to become permanently flattened at the sides will be assisted in so doing by the increased tension to which they are subjected in consequence of their initial lowering in the grooves. Those ropes, however, which are sufficiently elastic to fully recover their circular form when free of the pulleys, ride higher in the groove, and the consequent diminution of their tension assists them to retain their normal shape.

The cause of rope rotation is not very evident, and it is certainly difficult to explain why, in a set of ropes which are, to all intents and purposes, identical in make, age, length and diameter, some should persist in rotating, while others prove equally obdurate in this respect. It is frequently asserted that, by putting a twist into the rope before splicing, it may be made to revolve, but this does not appear to be generally correct. But whatever may be the cause of the rotation of ropes, it is, as a rule, conceded that it promotes their durability, as it tends to make them wear equally all round, and thus to prolong their life.

Loss Due to Journal Friction.—In many large installations of rope-driving plants, especially in that used for mill-driving, loss of power is indirectly entailed by the increased journal friction of the engine due to the use of large and heavy rope driving fly-wheels. Moreover, in large power plants the width of the wheel frequently necessitates the bearings being placed further apart than desirable. In the usual system of driving cotton-mills by multiple ropes, the pull of the ropes, however, neutralizes the pressure on the crankshaft bearings to some extent. There is also a decided loss of power at the end journals of the several line shafts, particularly with those in the upper stories of the mill building. In the latter case, the pull of the rope acts nearly in the same direction as the weight of the shaft and driven pulley; also, it may be noted, the sum of the rope tensions at the upper pulley is greater than the sum of those acting at the lower pulley by $2\,w\,h$, in which w is the weight per foot run of the rope, and h the difference in vertical height of the two pulleys.

MANUFACTURES

The Mahoning Valley (Pa) Iron Company has been making extensive repairs at its Hubbard Mills.

There is talk of the erection of a steel-rail-mill at Kanawha City, W. Va. D. A. Chenowith is interested.

A rail and puddling-mill company has been established at Norfolk, Va., with a capital stock of $100,000.

At Birmingham, Ala., the Henderson Steel Works is being repaired and put in order, preparatory to opening the blasts again.

Ricketts & Banks, 104 John street, New York, issue a little pamphlet setting forth their facilities for testing ores and investigating manufacturing processes.

The Riverside Iron Works, Benwood, W. Va., will build a new 21 inch plate-mill at its works, thus doubling its plant's capacity; work on it has commenced.

M. C. Hammett, Troy, N. Y., issue a circular of the Ideal Drawing Stand that was illustrated in our issue of January 28, 1891. It is an excellent drawing table.

Foster & Weymouth, Rumford Falls, Me., have leased a mill lot, and will build a mill this fall, 40x80, two stories, for the manufacture of doors, sash, blinds, etc.

There is to be a new canning factory at Springfield, Ill. $15,000 has been subscribed. The board of directors are: P. F. Kimble, Frank Elshoff, H. M. Snape, J. W. Vance and Dr. A. L. Converse.

The Harper Manufacturing Company, whose 12-set woolen-mill at Welchville (Oxford), Me., was burned a year ago, have decided to rebuild the plant. They will construct one of the largest and best equipped mills in the State.

The Ingersoll-Sargeant Rock Drill Co. is building large shops at Easton, Pa., by which the present capacity of the works will be more than doubled. Their present quarters in New York are entirely inadequate for their increasing business.

At Anderson, Ind., the Arrow Co. has been incorporated—capital, $150,000—for the manufacture and sale of rods, wire nails, and other articles of iron or steel. Incorporators: Walter H. Field, Jno. F. Hazen, Geo. E. Day, Wm. L. Finch, Wm. P. Anderson.

The Reading (Pa.) Rolling-mill Company have received the contract for the structural iron for a 17-story office building in Chicago. The contract will require 1,500 tons of structural iron. The mill is running double turn, and over 700 men are on the pay rolls.

The Secretary of State of Illinois has licensed the following new companies: Columbia Mfg. Co., Decatur, Ill., capital stock, $25,000; incorporators, Milton Johnson, E. G. Allen and others. The Decatur Implement Co., Decatur, Ill., capital stock, $4 000; incorporators, W. H. Gray, P. A. Harkrader, and James Milliken.

Mr. Heber Wells, of 8 Spruce street, New York City, has issued a new illustrated price list of white metal pattern and brand letters for use on patterns. The illustrations show the letters in full size, and also in sections, so that a choice of the desired style of letters is easily made, the variety illustrated being quite comprehensive.

Josiah Ross, manufacturer of wood-working machinery, 1443 Niagara street, Buffalo, N. Y., has begun the erection of a large factory building adjoining his own shops, where he will rent rooms with power. The new shop will use a 300 horse-power compound condensing engine, which Mr. Ross thinks of building himself in his own shop.

Old Orchard (Me.) citizens, anxious to establish some kind of winter industry at the famous summer resort, are endeavoring to form a company for the manufacture of bolts. John Duff, proprietor of the Lowell House, is one of the promoters of the scheme. Already the old electric light station has been purchased for the purpose. It is thought that a factory of this kind would furnish employment for about twenty-five men.

The Buffalo Steam Pump Co., of Buffalo, N. Y., have completed arrangements, and contracts have been let for the erection of new shops at North Tonawanda, N. Y., near Buffalo, for the purpose of meeting the wants of their increasing business. The foundry and pattern shop will be 80x350 feet. The machine and erecting shops will be 200x225 feet. The shops will have stone foundations and brick walls, and will be equipped with traveling crane and improved machinery. The building contracts will be let within a few days.

The Snow Steam Pump Works, of Buffalo, N. Y., are now completing the new machine shop which they have been erecting adjoining their present works, and which they expect to occupy during the coming winter. The new shop is of brick, with iron girders, two-story, and Superintendent A. C. Christensen, who is well known to many readers of the AMERICAN MACHINIST, estimates that the new shop will multiply the present capacity of the works about five or six times. The works now employ about 150 men in the manufacture of steam pumps. The company have begun to order machinery to equip the new shop, and expect to engage in the manufacture of water-works machinery as well.

The Bowdoin Paper Manufacturing Company, operating the extensive paper mill at Topsham, Me., are to build a $250,000 pulp-mill at Simpson's Rips on the Androscoggin, four miles above their present location. A Topsham town meeting held recently voted practically to abate the taxes on the mill and dam property above $30,000 for ten years. It is proposed to commence work at once on the new structure, and Topsham is looking forward to a new era of prosperity when the wheels of the mill begin to turn. The site of the proposed plant is about half way between Brunswick and Lisbon Falls, on the line of the railroad, so that excellent facilities are offered for the shipping of the pulp. The Dennison Manufacturing Company has owned the water privilege, which is an exceptionally fine one.

A Williamsport (Pa.) paper has the following: Mr. John N. Stearns, the leading man in the establishment of the silk factory in this city, was at The Updegraff recently. He brought with him a rough sketch of the plans for the buildings that are to be erected, which was placed in the hands of Messrs. Culver & Hudson, the architects, and then took a look over the grounds on which the buildings are to be erected, at Erie avenue and Stevens street, the site having been donated by Hon. R. J. C. Walker, which is a magnificent gift of at least $10,500. The plans are to be finished in one week from yesterday, and Mr. Stearns expects to have his estimates in one week thereafter. Whoever secures the contract will have to erect the buildings as rapidly as possible. The buildings will be of brick, and one of them will be four stories in height, with a front of 45 feet, and depth of 250 feet. The other building, which will be filled with heavy machinery, and have boiler and engine departments, will be one story in height, have a frontage of 100 feet and depth of 250 feet, with a skylight roof. The office will be in the four-story building. The ground given by Hon. R. J. C. Walker extends 300 feet on Stevens street, and 250 feet on Erie avenue. Mr. Stearns says that the girls to be employed in this establishment will be taken from Williamsport and vicinity.

Machinists' Supplies and Iron.

NEW YORK, November 26, 1892.

Iron—American Pig—We quote Standard Northern brands, No. 1 Foundry, $15 to $15.50; No. 2, $14 to $14.50; Gray Forge, $13 to $14. Southern brands of good quality are obtainable at $15 to $15.50 for No. 1 Foundry; $13.50 to $14 for No. 2; and $12.25 to $13 for Gray Forge.

Scotch Pig—Coltness is quoted at $21; and $20 for Eglington.

Antimony—The market continues steady. We quote L. X., 11¼c. to 11½c.; Cookson's, 11⅞c. to 12c.; Hallett's, 10¾c. to 10⅞c.

Copper—Buyers are holding off, and no business has been transacted. The nominal price for Lake Copper is 12c. Casting Copper is held at 11¼c. to 11½c.

Lead—The market is dull. There are offerings at 3.80c., while 3.75c. is bid.

Lard Oil—Prime City is quoted at 85c. to 87c.; Western on spot at 83c. to 85c.

Spelter—No business has been transacted; it is believed that 4.40c. would buy New York delivery. There seems to be no disposition to sell at a lower figure.

Tin—The market is stronger. The ruling prices seem to be from 20.55c. to 21c.

WANTED

"Situation and Help" Advertisements only inserted under this head. Rate 30 cents a line for each insertion. Seven words make a line, and the address as desired to appear should be included. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded.

Wanted—Twenty-five good machinists. Apply to Bath Iron Works, Bath, Maine.

First-class tool maker wants situation in New York or vicinity. Box 48, AMERICAN MACHINIST.

Wanted—Machine blacksmith, and two 1st-class machinists on job work. Box 50, AM. MACHINIST.

Mechanical engineer, experienced in steam and steam power plants, power-transmitting and pumping mach'y, wants situation. "Buffalo," AM. MACH.

Position as foreman, by one holding such a position at present, but desires to make a change. Address Box 52, AMERICAN MACHINIST.

Wanted—Position as sup't or foreman; successful in the systematic mfg. of machine tools, automatic & interchg'ble mach'y. H., Box 310, Florence, Mass.

Position as foreman machinist, by man versed in marine, stationary, and new and general repairs; best of reference. Address C. C., AM. MACHINIST.

✲WANTED✲

"Situation and Help" Advertisements only inserted under this head. Rate 30 cents a line for each insertion. About seven words make a line. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded.

Mechanical draftsman, with considerable experience on engines, special tools, and general machinery, is open for engagement. A 29, AM. MACH.

To Patent Solicitors—A first-class patent office draftsman wants position in New York; exp'd on high-class and intricate cases. Patents, AM. MACH.

Wanted—Situation by A1 pattern maker, 18 years' experience on large variety of work; western town preferred. Address J. F. P., AM. MACHINIST.

Position as superintendent, by one who at present is employed as foreman in one of the first-class shops in the country. Address Box 53, AM. MACH.

Draftsman wanted in Brooklyn; one who can make a neat and accurate drawing, and having some exp. in field work. Railroad, care AM. MACH.

Wanted—A first-class draftsman competent to take entire charge of our drawing-room. Address, stating experience, and salary required, Sioux City Engine Works, Sioux City, Iowa.

Wanted—Position as designer and draftsman, by graduate of one of lead'g engineer'g colleges; exp. in eng. design'g and testing, mach. tools, structural work and crane work of all kinds, electric, steam, hydraulic & power; also shop exp. Box 55, AM. MACH.

Wanted—Foreman for machine shop making harvesters and binders, mowers, etc. Must understand how to give out piece work and be a good manager of men. The town has 4,000 population and is situated on the C. P. R. Frost & Wood, Smith's Falls, Ont, Canada.

A competent planer hand wanted; one that is accustomed to doing light, close, accurate work; must be of good habits, and reliable; to the right person will be offered a steady position; state age, wages, and experience. Address R. M. Co., AMERICAN MACHINIST.

Wanted—Chief draftsman and designer, well up in steam, compression & pump'g mach'y, and able to take supt's place in making estimates and looking after shop during his frequent absence; must know modern methods; state age, nationality, exp., and salary expected. Box 51, AM. MACHINIST.

Wanted—Young man with some knowledge of mechanical drawing as assistant draftsman; would prefer undergraduate, or graduate of technical school. Address Box 54, AMERICAN MACHINIST.

✢ MISCELLANEOUS WANTS ✢

Advertisements will be inserted under this head at 85 cents per line, each insertion. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded.

Cheap 2d-hd lathes & planers. S.M.York,Clev'd,O.

Best Steel Flue Scrapers. Kelley Co., Erie, Pa.

For Sale—Second-hand drill presses, engine lathes and planers. Dietz, Gang & Co., Cincinnati, O.

Light and fine machinery to order; Foot Lathe Catalogue for stamp. E. O. Chase, Newark, N. J.

Best Bolt Header in the world for $50. Address C. H. Baush & Sons, Holyoke, Mass.

Engines, special and gen. mach'y designed; ideas developed. A. W. Jacobi, 136 Liberty St., N. Y.

Wanted—Hardware specialties to build. Send 25 cents for "Eureka Knife and Shears Sharpener." W. A. Smith & Co., 227 Eddy Street, Providence, R.I.

For sale Machine shop and supply store, doing an increasing business in a growing city. Address Box 49, AMERICAN MACHINIST.

Practical machinist with $2,000 or more, competent to take charge of small plant in Wisconsin; can succeed to old established paying business on favorable terms, owner retiring. Box 45, AM. MACH.

We will pay 25 cents each for copies of the AMERICAN MACHINIST of December 25, 1886, issue; must be unsoiled and in good condition. AMERICAN MACHINIST PUBLISHING COMPANY, 203 Broadway, New York.

Bradley Hammers.

If you plate, draw, square, taper, swage, collar, spindle, or do any manner of die forging in iron or steel, a BRADLEY HAMMER will soon pay for itself, by what it will save over any other similar tool. Send for circulars.

BRADLEY & COMPANY, SYRACUSE, N. Y.

Books for Molders.

Dingey's Machinery Pattern-Maker.
12mo. Cloth. $2.

BOLLAND, THE IRON FOUNDER.
12mo. Cloth. $2.50.
JOHN WILEY & SONS, - NEW YORK

SENSITIVE KNEE DRILL

Both hands to handle work. Double capacity over old plan.
SEND FOR CIRCULAR.
BRADY MFG. CO.
83 Washington St., Brooklyn, N. Y.

PATTERN MAKERS' SHOOT PLANE & JACK BOARD.

A. J. WILKINSON & CO.
Box 3600,
BOSTON, MASS.
SEND FOR CIRCULAR.

THE MASON PUMP PRESSURE REGULATOR.

For fire, tank, elevator, air and water works pumps, or any class of pumping machinery where it is necessary to maintain a constant pressure. The regulator may be instantly adjusted to any pressure desired by simply turning the key as shown in the cut.

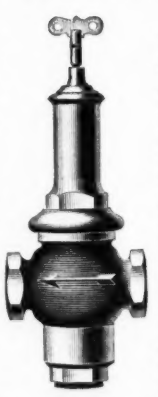
The especial feature of this regulator is that the pressure chamber into which the water enters is entirely removed and separate from the steam and all working parts.

The long cylinder at the bottom of the regulator is a dashpot, the piston of which is connected with the main valve of the regulator, thereby preventing sudden and violent "jumping" of the pump when the pressure suddenly changes.

For automatic fire sprinkler service they have been found especially valuable, as the valve is thrown wide open immediately the slightest drop in pressure occurs. On application we can refer parties where they are in use.

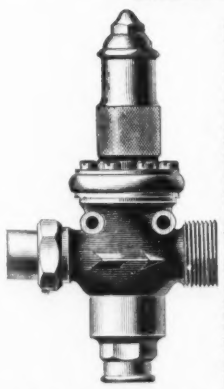
These regulators are made in all the pipe sizes; those up to and including two inch, of the best steam metal, the largest sizes of cast iron lined with steam metal. The springs are made of the finest tool steel, tempered.

THE MASON REDUCING VALVE.



This valve is designed to reduce and maintain an even steam or air pressure, regardless of the initial pressure. It will automatically reduce boiler pressure for steam-heating coils, dry-rooms, paper-making machinery, slashers, dye-kettles, and all places where it is desirable to use lower pressure than that of the boiler. The dashpot, which immediately fills with condensation, prevents all chattering or pounding, and requires no attention. No extra lock-up attachment is needed, as the pressure is regulated by a key which the engineer retains. The sizes, up to and including 2-inch, are made of the best composition, and above that of cast iron, with composition linings. In the larger sizes the composition lining is hung up in the valve, leaving a space between the iron and composition for the unequal expansion of the metals; thus there is no possibility of the piston sticking when the valve is heated. The area of the passage from the high to the low pressure side of the valve is equal, when open, to the full area of the pipe, so that a low pressure of the system, almost equal to the initial high pressure, may be carried. This valve will maintain an even steam or air pressure as low as one pound if necessary. We make an iron valve for use with ammonia in ice-making machinery.

THE MASON AIR BRAKE PUMP REGULATOR.



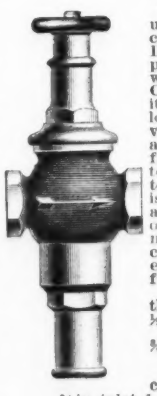
This is constructed on the same principle as our pump pressure regulator, but with a few small changes, so as to allow of its application to air brake pumps without changing the fittings on the locomotive. It is only necessary to place these in the steam pipe leading to the pump and connect the air pressure pipe with the train service pipe. As the air chamber is entirely separate from the steam and working parts, any particles of dirt which may get into the main service pipe cannot get into the working parts of the regulator and thence into the pump, neither can the steam and air pressure have access to each other. The regulator is fitted with couplings, so that no change in piping will be necessary in substituting it for those now in use. These regulators are the standard on more than thirty railroads. Among these using large quantities we refer to the Pennsylvania, Boston and Albany, Chicago, Rock Island and Pacific, Richmond and Danville, Chesapeake and Ohio, Fitchburg, etc.

We will send one on trial to any railroad. Weight with couplings, 8½ lbs.

Price, $15.00 net.

We also manufacture in connection with this regulator an attachment by means of which the air pressure may be taken both from the reservoir and the train service pipe, thereby keeping each at its normal amount and lessening the danger of bursting the hose connections. Price, $6.00 net.

THE MASON LOCOMOTIVE REDUCING VALVE.



This reducing valve has been in use by the leading steam car heating companies for the last three years. During that time over 500 have been placed on nearly every railroad which has adopted steam heat. One feature which will commend itself to every engineer is the self-locking device, which enables the valve to be set for any pressure, and automatically locked. In the manufacture of this valve there is no attempt made to save on stock in order to cheapen the price. Every valve is made of the best steam metal, and will not steam-cut at a pressure of 180 lbs. As we supply a large number of car-heating and railroad companies, each of whom use different connections, we are prepared to furnish the sizes as follows:

The ¾ size can be furnished with these connections. Price $18.

½ in. inlet, ¾ in. outlet, unions both ends.

¾ in. inlet, ¾ in. outlet, unions both ends.

The 1 in. size, with the following connections. Price $22.

¾ in. inlet, 1 in. outlet, unions both ends.
¾ " 1¼ " " " "
1 " 1¼ " " " "
1 " 1 " " " "

⅜ copper pipe inlet, 1½ inch screwed outlet.

MANUFACTURED BY

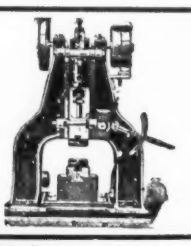
MASON REGULATOR CO.,

Boston, Mass., U. S. A.

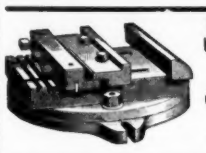
HACKNEY HAMMERS

Meet all requirements more fully and satisfactorily than any other of its competitors.

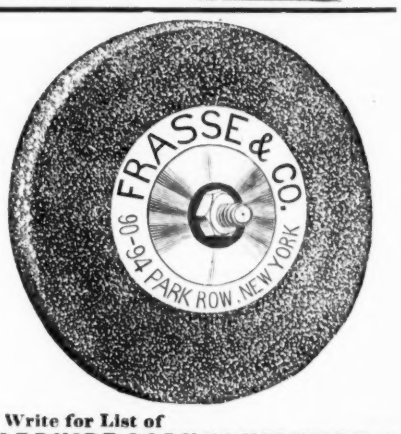
INVESTIGATION IS NOT COSTLY.
INVESTIGATION IS CONVINCING.



WRITE FOR CATALOGUE TO
THE HACKNEY HAMMER CO.
20 Johnson St., CLEVELAND, O.

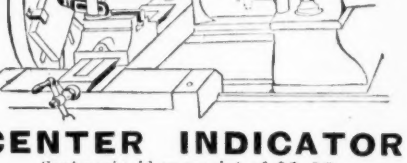


Jordan Planer Chucks.
SEND FOR CIRCULAR.
C. W. JORDAN,
4 Wayne St.
WORCESTER, MASS.

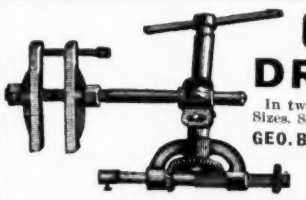


Write for List of
SAPPHIRE CORUNDUM WHEELS
FRASSE & CO., 90-94 PARK ROW, NEW YORK.

VANDERBEEK'S
NEW COUNTERSHAFTS.
NEW CONSTRUCTION,
NEW FRICTION AND SELF-OILING
THROUGHOUT.
THE STATES MACHINE CO.,
HARTFORD, CONN



CENTER INDICATOR
Sent postpaid on receipt of $1.50.
S. A. SMITH, 23 So. Canal St., Chicago, Ill.



CLAMP DRILLS
In two Styles and four Sizes. Send for circular to
GEO. BURNHAM & CO.,
Worcester,
MASS.

No. 1
TRAVELING CRANE, On Wood Overhead Beams.
CAPACITY, 3,000.
PRICE OF MACHINE, - - $100.00.
Timber, Bolts, Track Iron for overhead frame, 11.50.
Send for Illustrated Circular, giving full details.
T. SHRIVER & CO. 333 E. 56TH ST. NEW YORK.

BRASS-WORKING TOOLS.

SPECIAL MACHINERY.

BARDONS & OLIVER
Cleveland, Ohio.

PRICES on APPLICATION

SCREW MACHINES.

BALLS

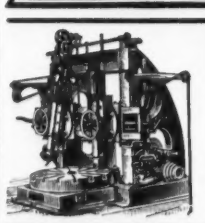
For all Anti-Friction Purposes.

STEEL BALLS from ⅛" to 1"

READY FOR IMMEDIATE SHIPMENT.

Sizes up to 3" in a short time. Aluminoid hard as hardened tool steel all sizes above ½". Write for prices and samples.

GRANT ANTI-FRICTION BALL CO., Fitchburg, Mass.



BORING AND TURNING MILLS

COMBINING EVERY IMPROVEMENT.

14 SIZES FROM 5 TO 20 FEET.

BETTS MACHINE COMPANY,
WILMINGTON, DEL.

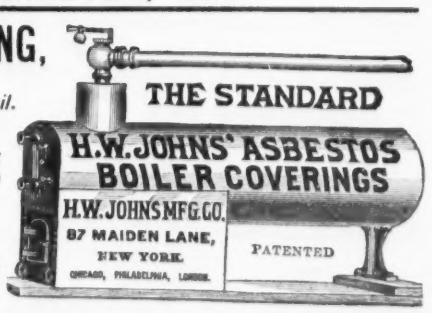
ASBESTOS CEMENT FELTING,

FOR LAGGING LOCOMOTIVE BOILERS.

Samples and Descriptive Price List Free by Mail.

We are prepared to take Contracts for applying Steam Pipe and Boiler Coverings in any part of the United States.

H. W. JOHNS MANUFACTURING CO.,
87 Maiden Lane, NEW YORK.



✣ MISCELLANEOUS WANTS ✣

Advertisements will be inserted under this head at 25 cents per line, each insertion. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded.

For Sale—Corliss steam eng. 100 H. P., with boilers, shafting, etc.; a bargain for some one. Address Orrin E. Jones, 416 High St., Providence, R. I.

Special, experimental or other light machinery manufactured. Best equipped shop in the West for fine work. Manufacture one of the best hollow spindle bench lathes for the tool room or for manufacturing. Write us. Moseley & Co., Elgin, Ill.

Sale of American Patent. Peter Heintz, Ludwigshafer a. Rh. The simplest and best file-cutting machine in the world; the best investment for capital. High profits. Will be sold under favorable conditions by Peter Heintz, Ludwigshafer a Rh. Bayer, Pfalz.

Screw-cutting lathe, 24" swing, 20 foot bed, $260; cost $950. Massive Tool, 229, AMERICAN MACHINIST.

The *Engineering Record*, the recognized authority on Municipal and Building Engineering, has recently been enlarged by the addition of a department in which notable industrial plants are regularly described and illustrated, the steam and power plants being a conspicuous feature. Recent publications include the great Ivorydale plant of Messrs. Proctor & Gamble, described in 23 columns and illustrated by 57 drawings. The steam plant at Ivorydale is separately treated in 13 columns and 31 drawings. The New Foundry of Henry R. Worthington, at Elizabethport, N. J., 16 columns, 26 illustrations. National Meter Company's Foundry and Brass Finishing Shop, Brooklyn, 13 columns, 29 illustrations. Niagara Power Plant (now in process of publication), 6 columns, 6 illustrations. Steam Power Plant of the Dwight Manufacturing Co., Chicopee, Mass., 9 columns, 7 illustrations. Published Saturdays. 12 cents a copy. The *Engineering Record*, 277 Pearl St., New York.

MACHINE TOOLS

IN STOCK.

LATHES.

All sizes of FLATHER.
" " BLAISDELL.
" " FIFIELD.
One each, 14"x6' and 24"x12' FITCHBURG.
One 78"x15' SELLERS.

PLANERS.

All sizes of WHITCOMB.
" " FLATHER.
One each, 30"x8' and 36"x8' PEASE.

DRILLS.

All sizes of PRENTICE.
" " BLAISDELL.
One 5' CINCINNATI RADIAL.
One 8" NEWTON SLOTTER.
All sizes of HENDEY and EBERHARDT SHAPERS.

WRITE FOR PRICES.

HILL, CLARKE & CO.,

156 OLIVER ST., BOSTON, MASS.
CHICAGO BRANCH, 12 and 14 South Canal Street.

LOOK!!!

We are just receiving a large lot of fine Second-hand Machinery, the entire outfit of two large factories.

This is the nicest lot of Second-hand Tools ever put on the New York market, comprising nearly everything in Metal-Working Machinery, of Pratt & Whitney, Brown & Sharpe, Prentice Bros., F. E. Reed, The Diamond Machine Co., and other well-known makes.

It is now on exhibition at our warerooms, **Laight and Canal Sts.** Call and make your selections, or write for free list and particulars.

THE GARVIN MACHINE CO.,
NEW YORK.

SECOND-HAND AND NEW MACHINERY. ON HAND.

84 in.x72in.x12 ft. Planer 2 Heads, H. & P.
10 ft.x10 ft.x16 ft. Planer. 1 Head.
62 in.x61 in.x9 ft. 2 Heads, Bement.
72 in.x48x30 ft. 3 Heads.
60 in.x48 in.x17 ft. do 1 do
54 in.x42 in.x24½ ft. do 2 do
42 in.x42 in.x16 ft. do 1 do
39 in.x36 in.x12 ft. do 1 do
36 in.x38 in.x8 ft. do Powell Al.
30 in.x30 in.x7 & 8 ft. do 1 Head.
26 in.x26 in.x6 ft. do 1 do
25 in.x24 in.x6 ft. do 1 do
22 in.x21 in.x5 ft. do 1 do
90 in. x30 ft. Triple Gear Engine Lathe, Ames Al.
50 in.x30 ft. Bed, Triple Geared. New Engine Lathe,
30 in.x28 ft. Pond Mach. Tool Co., Shafting Lathe.
32 in.x12, 14, 16, 18 ft. Bed. New Engine do
28 in.x12, 14, 16, 18 ft. do do do do
21 in.x10, 12 ft. do do do do
20 in.x 7½ & 8 ft. do 2d Hand do do
18 in.x 6, 7 & 8 ft. do New & do do do
17 in.x 8 ft. do do do do
16 in.x 6 & 8 ft. do do do do do
15 in.x 6 & 8 ft. do do do do do
14 in.x 6 ft. do do do do do
Car Axle Lathe, Bement.
15, 16, 18, 25 in. Crank Shapers.
20, 24, 26 & 30 in. Geared Shapers.
20, 22, 24, 28, 30 & 36 in. Drills.
Bolt Cutters.
1 Bk. Geared Miller. U. V. Co. Good.
1100 and 3000 lb. Bement Steam Hammer.
100 and 150 lb. Steam Hammer.
42 in. Sellers Hyd. Wheel Press.

GEO. PLACE MACHINE CO.,
120 BROADWAY. NEW YORK

MACHINERY—New and Second-Hand.

Engine Lathe, 13 in.x6 ft., 1 1 16 in. hole, Cpd. Rest. Complete
" " 14 in.x6 ft. Taper and Plain. Hendey and Fitchburg. Improved Patterns.
" " 16 in.x 6-8 ft. Taper and Plain. Hendey and Fitchburg. Improved Patterns.
" " 18 in.x8 ft. Rod and Screw. New Haven. Good.
" " 20 in.x10 ft. Cpd. Rest, Cross feed, Special feature and Chuck. Ames. Good.
" " 20 in.x18 ft. Rod and Screw. Cpd. Rest and Chuck. Lathe & Morse. Good.
" " 24 in.x12 ft Putnam. Complete. A 1 order.
" " 28 in.x16 ft. Improved heavy Pattern. New.
" " 32 in.x12 ft. Standard. Complete.
" " 60 in.x20 ft. Old Style. Low Price.
Turret and Square Arbor Brass Lathes.
Planer, 22 in.x 4 ft. Old Style. Low Price.
" 24 in.x 5 ft. Whitcomb, full auto. feeds.
" 27 in.x 6 ft. Pond, full auto. Good.
" 30 in.x10 ft. Powell, Latest Pattern.
" 54 in.x20 ft. Heavy Pattern. Good order.
" 60 in.x12 ft. Old Style. Low Price.
Shaper, 6 in. Crank. Good order. Low Price.
" 8 in. " Gould Good order.
" 9 in. " Hewes & Phillips, Extra Heavy.
" 13 in. Trav. head, Two Tables. Ex. heavy.
" 14 in " " Fitchburg. Latest Pattern
" 16 in. Crank. Gould & Eberhardt. A 1 order.
" 28 in. Triple-geared. Latest Pattern.
Slotter, 8 in., Modern Style Auto. Feeds and Quick return.
Pulley Machines, 26, 30, 36, 60 in. Improved Style.
Upright Boring and Turning Mill, 38 in. Good as new.
Screw Machine, 1⅝ in. hole. Brown & Sharpe.
" " 15 16 in. hole. Jones & Lamson.
" " 2¾ in. hole. No 11, with Clutch Gears, Chasing Bar and Tools complete. Jones & Lamson. A 1.
Profiling Machine, 2 spindle. Good order.
Universal Milling Machine. Improved Style.
Milling Machine. Improved Style. All sizes.
" " Lincoln Pattern. Good order.
Gang Drills, 3 and 4 Spindle. Pratt & Whitney.
Upright Drills, 20, 24, 28 and 32 in. Complete.
Radial " 52 and 86 in. Arms. Improved Style.
Bolt and Pipe Machines. Tool and Twist Drill Grinders.
Gear Cutters, &c.
Bliss Style, No. 20 Press. Good as new.
Boiler Bending Rolls. Improved Style, 8 and 10 ft. Hinged Housings.

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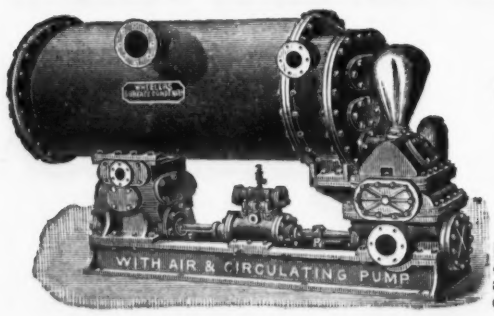

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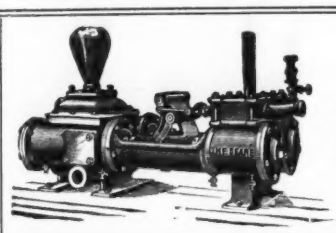

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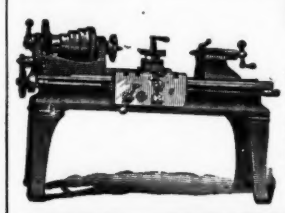

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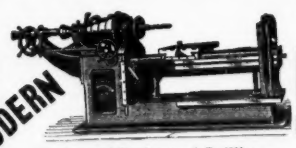

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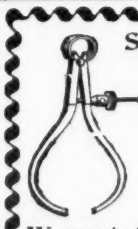

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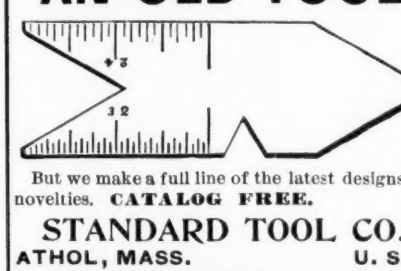

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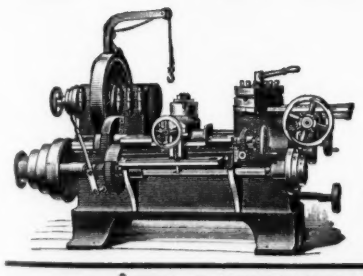

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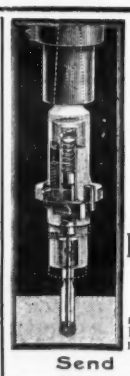

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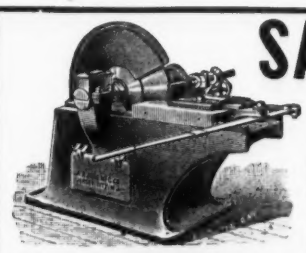

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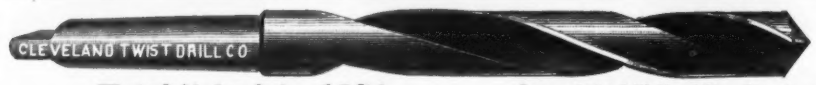

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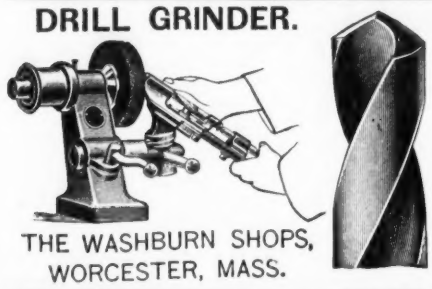

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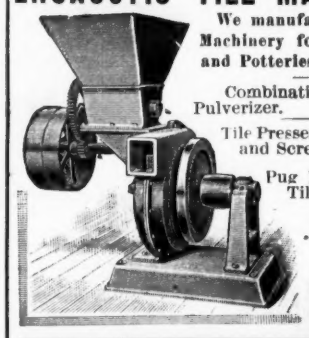

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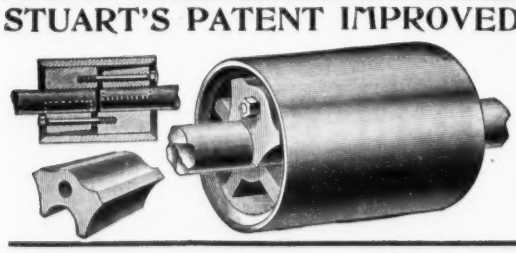

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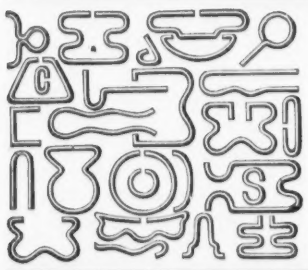

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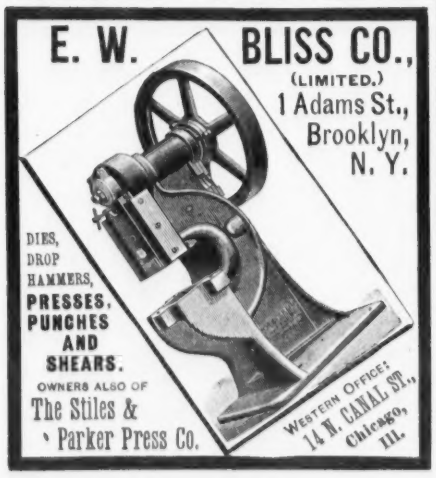

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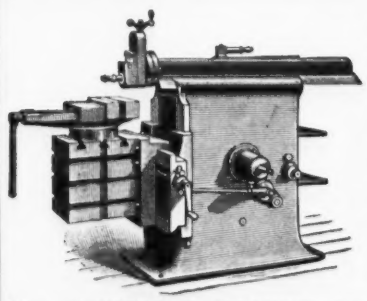

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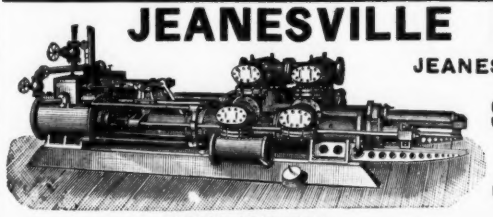

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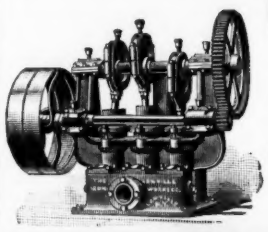

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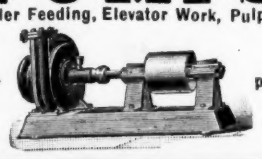

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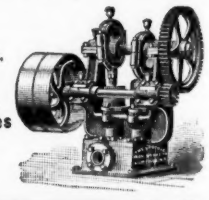

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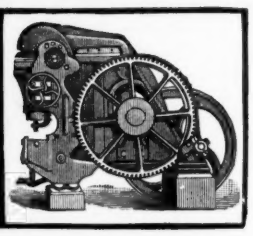

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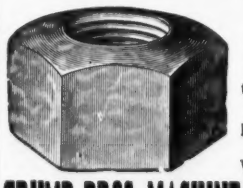

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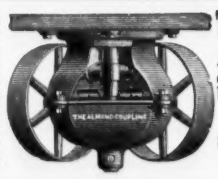

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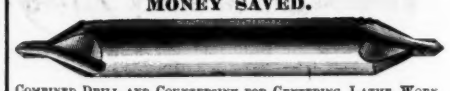

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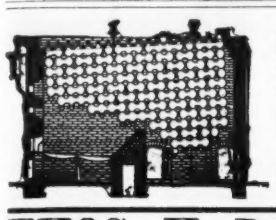

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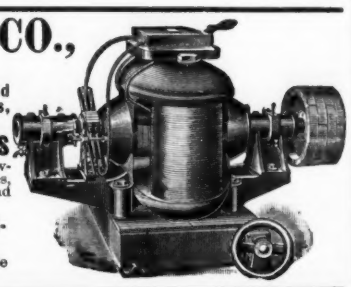

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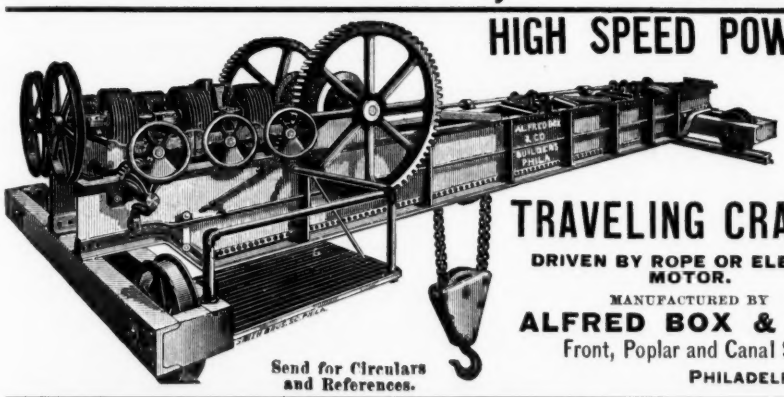

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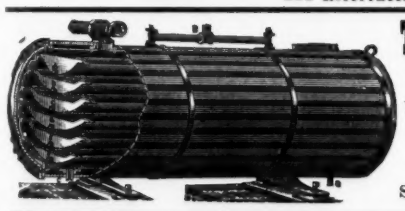

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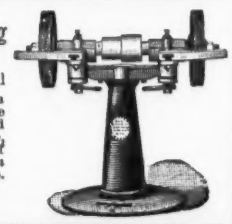

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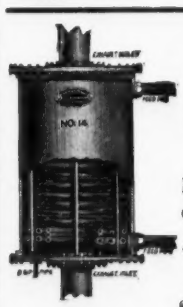

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18 "	19¾ "
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24 "	28 "
30 "	32½ "
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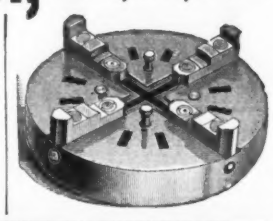

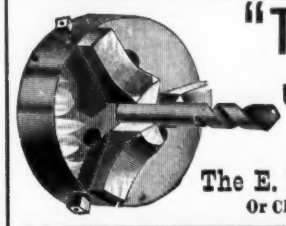

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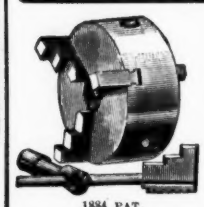

1884 PAT.

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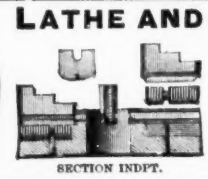

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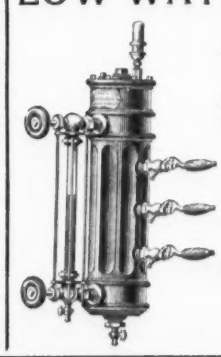

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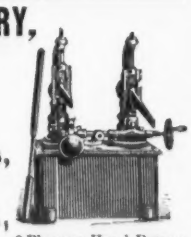

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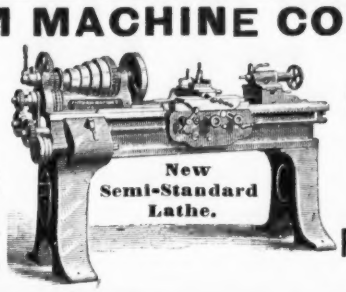

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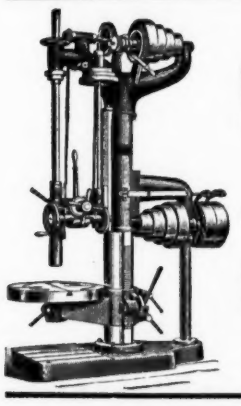

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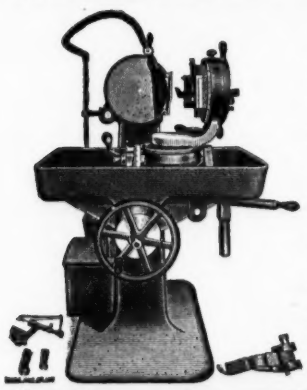

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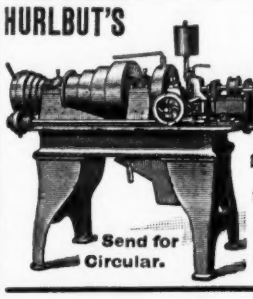

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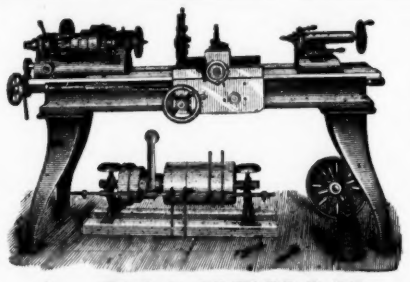

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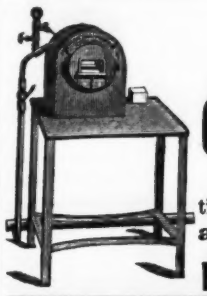

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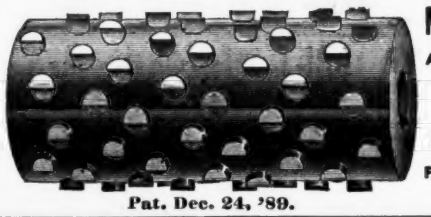

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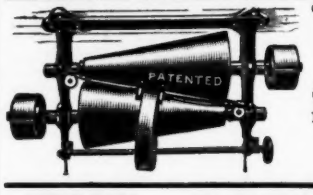

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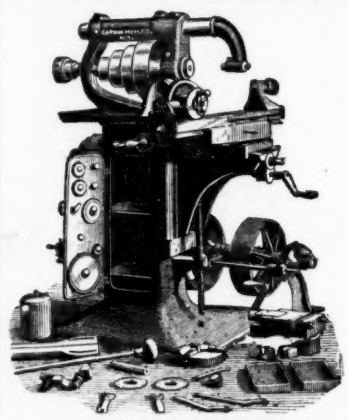

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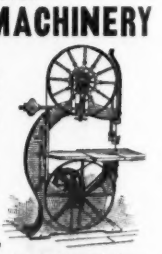

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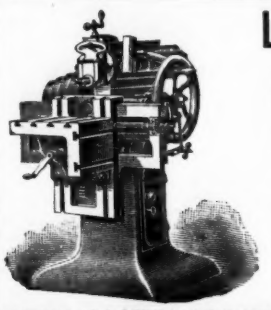

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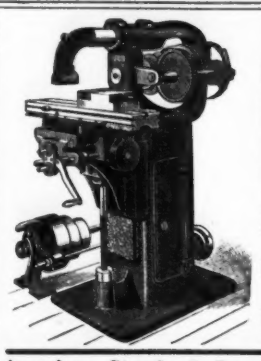

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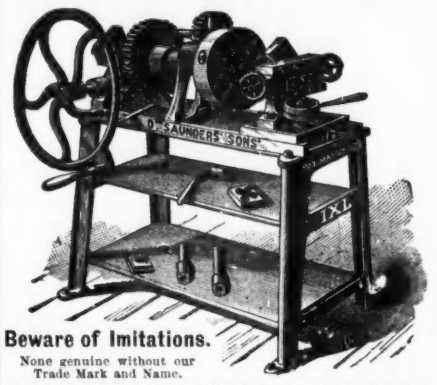

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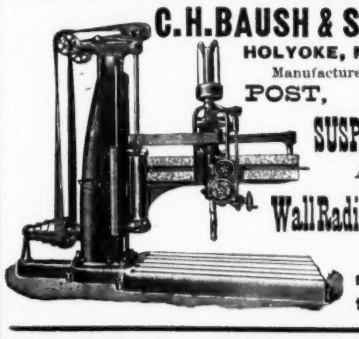

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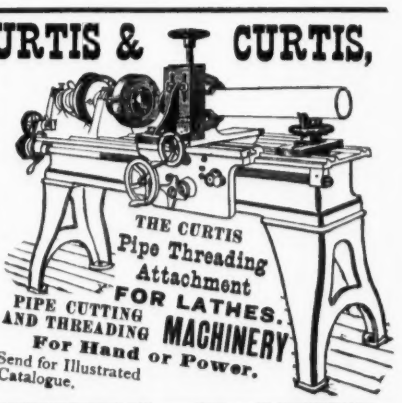

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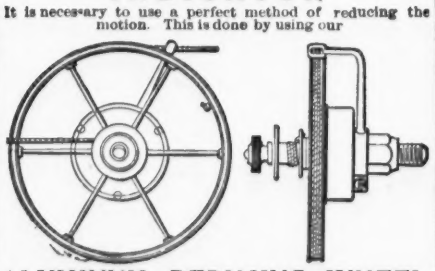

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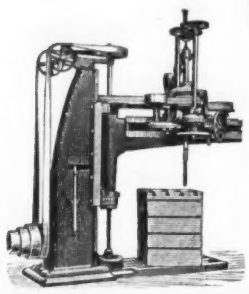

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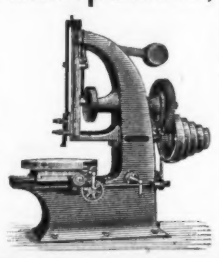

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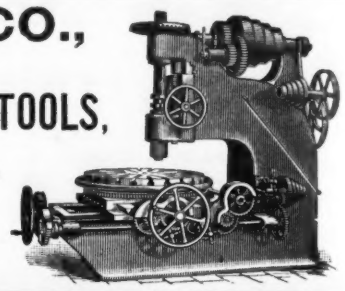

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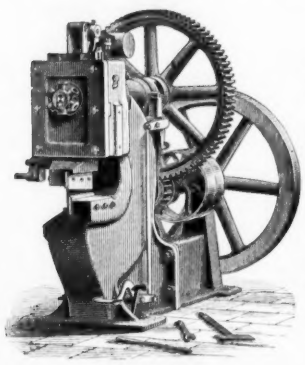

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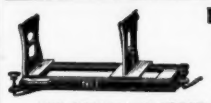

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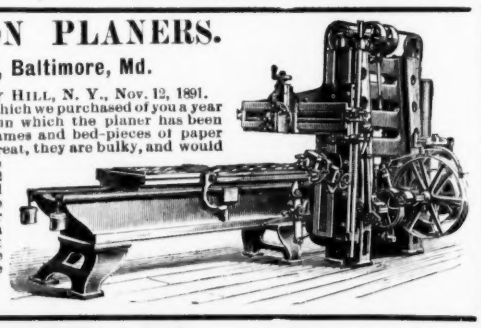

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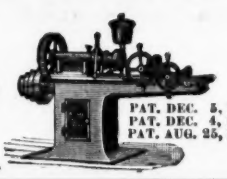

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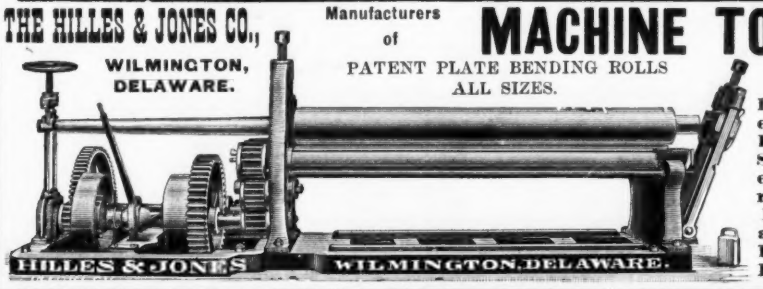

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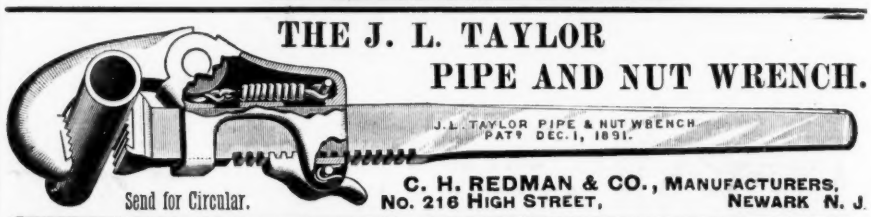

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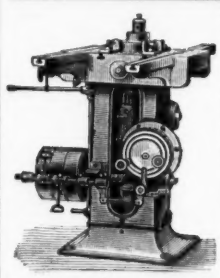

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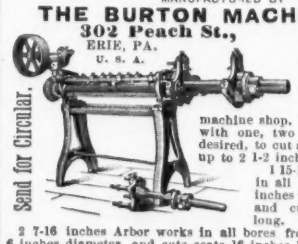

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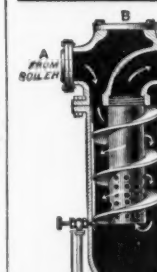

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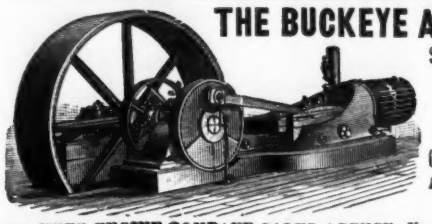

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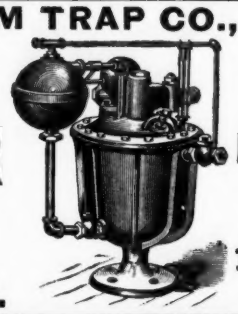

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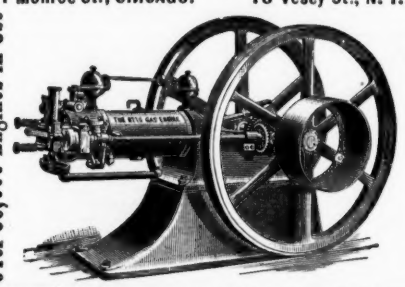

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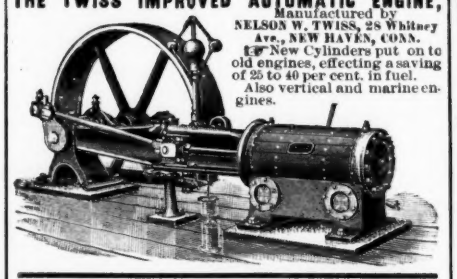

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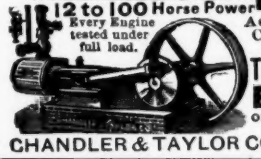

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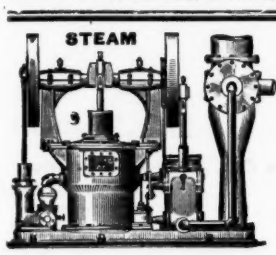

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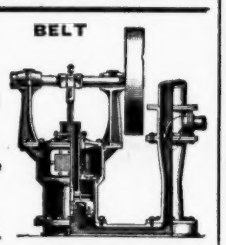

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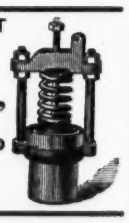

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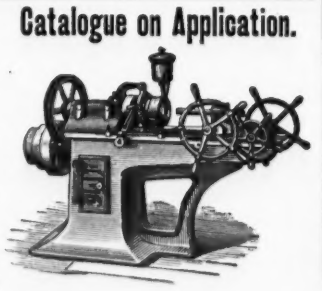

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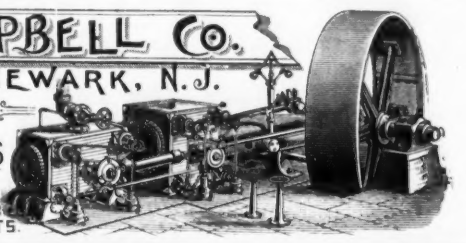

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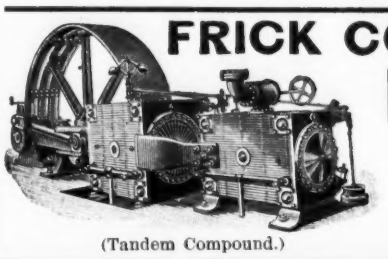

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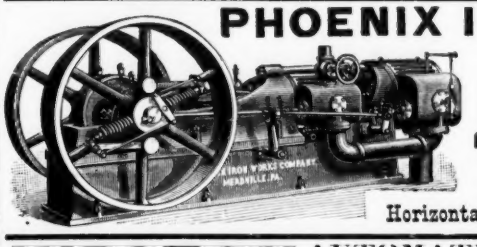

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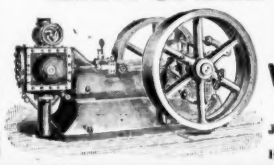

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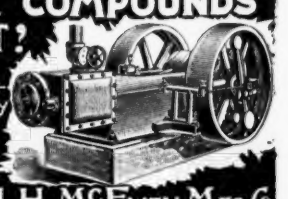

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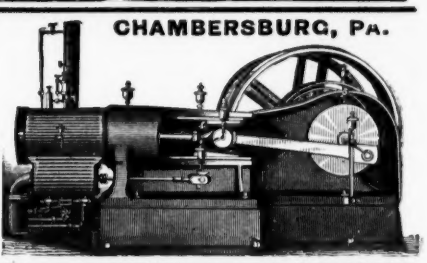

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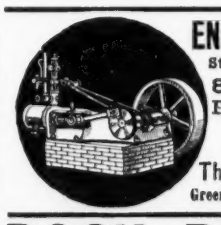

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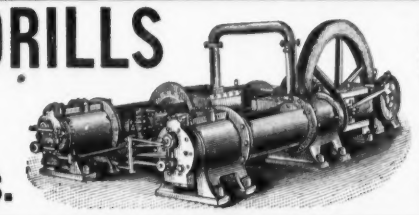

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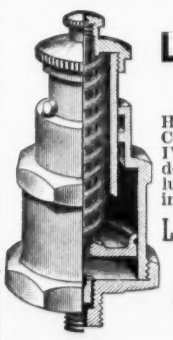

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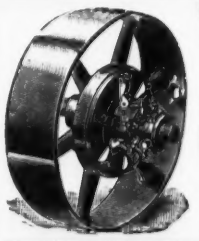

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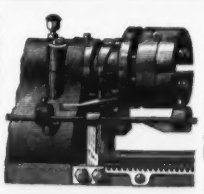

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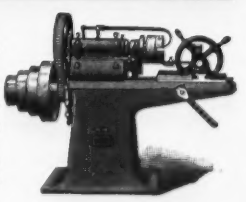

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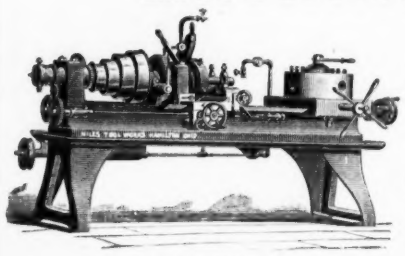

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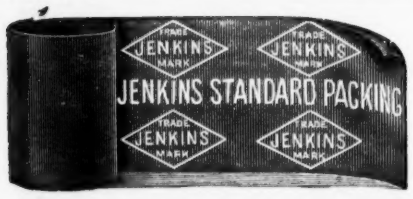

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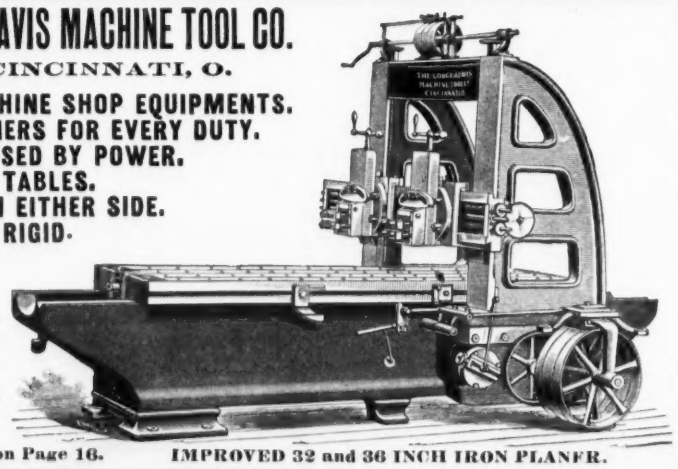

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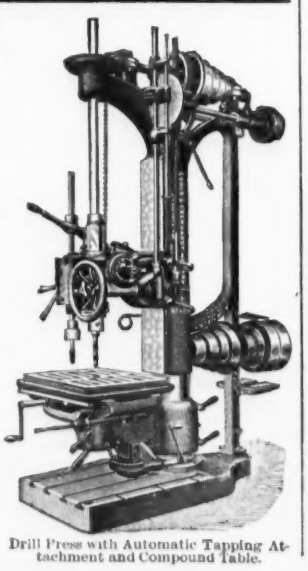

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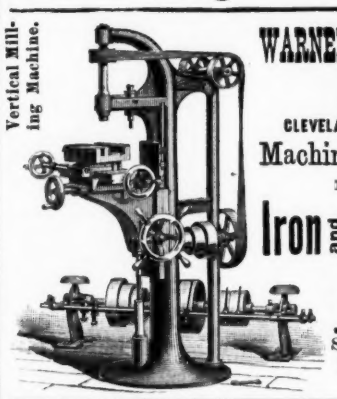

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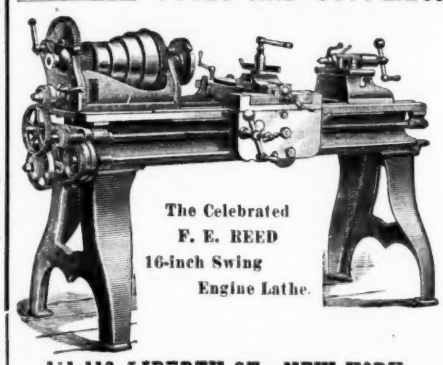

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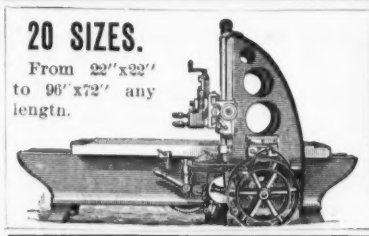

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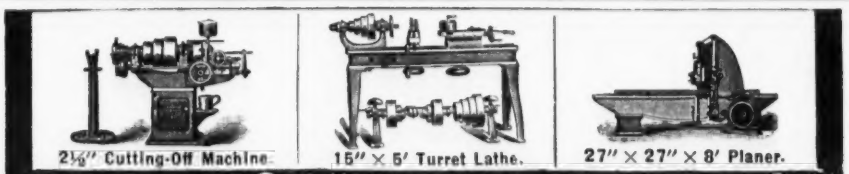

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